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Final

Munitions and Explosives of Concern Intrusive Investigation Work Plan Site UXO-04, Knox Trailer Park

Marine Corps Base Camp Lejeune Jacksonville, North Carolina

NAVFAC
Naval Facilities Engineering Command
NAVFAC ATLANTIC

Prepared for

Department of the Navy

Naval Facilities Engineering Command
Atlantic Division

Under the

NAVFAC CLEAN III Program
Contract No. N62470-02-D-3052
CTO-0109

November 2006

Prepared by

CH2MHILL

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Acronyms and Abbreviations

ASR	Archives Search Report
CD	Compact Disc
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CWM	Chemical Warfare Materiel
DDESB	Department of Defense Explosives Safety Board
°F	degree Fahrenheit
DERP	Defense Environmental Restoration Program
DGM	Digital Geophysical Mapping
DGPS	Differential Global Positioning System
DoD	U.S. Department of Defense
DQO	Data Quality Objective
EOD	Explosive Ordnance Disposal
EP	Engineering Pamphlet
EPP	Environmental Protection Plan
ESQD	Explosives Safety Quantity-Distance
ESRI	Environmental Systems Research Institute, Inc.
ESS	Explosives Safety Submission
EZ	Exclusion Zone
FTP	File Transfer Protocol
GIS	Geographical Information System
GPO	Geophysical Prove-out
GPS	Global Positioning System
GSA	General Services Administration
H&S	Health and Safety
HASP	Health and Safety Plan
IRP	Installation Restoration Program
lb.	Pound
m	Meter
MARCORSYSCOM	Marine Corps Systems Command
MC	Munitions Constituent
MD	Munitions Debris
MEC	Munitions and Explosives of Concern
mm	Millimeter
MMRP	Military Munitions Response Program
MPPEH	Material Potentially Presenting an Explosive Hazard
MRS	Munitions Response Site
MRSIMS	Munitions Response Site Information Management System
MSD	Minimum Separation Distance
NAD	North American Datum
NCDENR	North Carolina Department of Environment and Natural Resources

OSHA	Occupational Safety and Health Act/Occupational Safety and Health Administration
PLS	Professional Land Surveyor
PM	Project Manager
POC	Point of Contact
QA	Quality Assurance
QC	Quality Control
QCP	Quality Control Plan
RFP	Request for Proposal
SOP	Standard Operating Procedure
SUXOS	Senior UXO Supervisor
TBD	To Be Determined
TMP	Technical Management Plan
USA	USA Environmental, Inc.
USFWS	U.S. Fish and Wildlife Service
UXO	Unexploded Ordnance
UXOQCS	UXO QC Specialist
UXOSO	UXO Safety Officer
WP	Work Plan

1.0 Introduction

This Work Plan was prepared to support an intrusive investigation for munitions and explosives of concern (MEC) at Munitions Response Program (MRP) Site UXO-04, Knox Trailer Park, located at Marine Corps Base (MCB) Camp Lejeune, Jacksonville, North Carolina. This Work Plan is an addendum to the Work Plan for the Expanded Site Investigation (CH2M HILL, 2005).

1.1 Background and Project Objectives

Approximately 133 acres of land surrounding and including the current Knox Trailer Park has been targeted for a public–private venture (PPV) residential-housing development. Due to historical activities at the site, an Expanded Site Inspection (ESI) was conducted at the site in 2006. This ESI included digital geophysical mapping (DGM) to identify subsurface anomalies that potentially represent MEC

Based on the results of the DGM effort, a MEC intrusive investigation will be conducted to evaluate the nature and density of MEC that may be present at the existing Knox Trailer Park within Site UXO-04. This intrusive investigation will be conducted over ten percent of the non-wooded area that was geophysically surveyed within the current Knox Trailer Park.

1.2 Work Plan Scope and Organization

This intrusive investigation work plan provides background information needed to understand the project tasks, describes conditions at the site, and presents the technical approach to be used for implementation of the work activities. The following primary activities will be performed to accomplish the objectives described in Section 1.1:

- Reacquisition of the corners of 17 grids that were surveyed with a towed array EM61-MK2 during the DGM effort in early 2006
- Reacquisition of all geophysical anomalies that have been selected as representing potential subsurface MEC within the 17 grids
- Manual digging and identification of the sources of anomalies
- Disposing of anomaly source material (i.e., scrap metal)
- Excavation backfilling
- Preparation of an intrusive investigation report

This work plan is divided into Chapters providing information on the detailed approach, including procedures to be employed during the execution of the project. Appendices to the work plan provide supporting documentation that details specific procedures for the execution of the project.

This work plan is organized as follows:

- **Chapter 1, Introduction,** provides general information about this work plan and presents the project scope and objectives.
- **Chapter 2, Technical Management Plan,** identifies the technical approach, methods, and operational procedures that will be used to execute the intrusive investigation.
- **Chapter 3, Quality Control Plan,** provides details of the approach, methods, and operational procedures to be employed for quality control (QC) of the intrusive investigation at Knox Trailer Park
- **Chapter 4, Investigation Derived Waste Plan**
- **Chapter 5, References**
- **Appendix A, Geophysical Prove-out (GPO) Report**
- **Appendix B, Digital Geophysical Mapping (DGM) Report**
- **Appendix C, Health and Safety Plan (HASP),** provides an interface with CH2M HILL's overall health and safety program and with the draft MCB Camp Lejeune Master Health and Safety Plan (CH2M HILL, June 2004). The HASP also includes the MEC identification and avoidance procedures that will be used to ensure that onsite personnel are protected from MEC that may be present at the site.
- **Appendix D, MEC Removal SOPS**

An explosives safety submission (ESS) is being submitted to Marine Corps Systems Command (MARCORSYSCOM) under separate cover for review and approval.

An intrusive investigation work plan typically contains an explosives management plan and an explosives site plan. However, CH2M HILL and its subcontractors will not perform demolition on any MEC items that may be found during the course of this intrusive investigation. MCB Camp Lejeune EOD will take responsibility for demolition of all MEC items. Therefore, these additional plans are not applicable to this work plan.

1.3 Site Location, Background, and Description

This intrusive investigation is being conducted as part of an ESI of Site UXO-04, in which DGM was conducted as part of the ESI data collection effort. A GPO was performed at the site to validate a towed array EM61-MK2 system and a two man-portable single-coil system for DGM surveys across the site. Each system passed the project data quality objectives (DQOs) as established in the GPO Work Plan, which was presented as an appendix to the Work Plan for the ESI (CH2M HILL, October 2005). The GPO Report is attached as Appendix A.

A total of 90.9 acres were geophysically surveyed at the project site using a combination of a towed array EM61-MK2 system and two man-portable single-coil EM61-MK2 systems. A total of 38 acres were geophysically surveyed in the non-wooded area comprising the existing trailer park area where the MEC intrusive investigation will be conducted. The remaining 53 acres were in wooded areas of the site and will not be addressed by the MEC intrusive investigation.

The DGM results indicate a high density of anomalies due to metallic items in the current and former trailer park areas of the site. Anomalies that represent potential subsurface MEC items were identified based on their geophysical signatures. Anomalies with geophysical signatures similar to those of the target MEC item, an MKII hand grenade, were selected from the DGM results and their coordinates recorded. Over 50,000 anomalies representing subsurface metal were selected from the data as representing potential subsurface MEC items. Within the existing trailer park area of the site, an average 600 anomalies per acre were identified as representing potential subsurface MEC.

The concentration of targeted anomalies is significantly reduced in the southwest and southeast sections of the area of inspection, outside of the area of the planned MEC intrusive investigation. Results of DGM surveys in the wooded areas to the northeast of the trailer park indicate that there may be fewer anomalies in this area as well. The DGM report is attached as Appendix B**.**

Additional detailed information regarding the site location, background, and description can be found in the Work Plan for the Expanded Site Investigation (CH2M HILL, 2005). Results of the GPO and DGM effort, which will be used in the performance of the intrusive investigation, are provided as Appendix A and Appendix B to this WP.

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2.0 Technical Management Plan

The purpose of this TMP is to identify the approach, methods, and operational procedures to be employed in support of the MEC intrusive investigation at Knox Trailer Park, MRP Site UXO-04.

2.1 Guidance, Regulations, and Policies

The MEC intrusive investigation at Site UXO-04 will be conducted under the following guidance documents, regulations, and policies:

- **DDESB TP 16, *Methodologies for Calculating Primary Fragment Characteristics*.** Technical Paper (TP) 16 provides Department of Defense Explosives Safety Board (DDESB) approved methodologies for calculating the characteristics of primary fragments. It includes methodologies for calculating: primary fragment mass and velocity, maximum fragment range, hazardous fragment distance, effects of detonating stacks of items, effects of detonating buried items, and penetration information.
- **DDESB TP 18, *Minimum Qualifications for Unexploded Ordnance (UXO) Technicians and Personnel*.** This document provides minimum qualification standards for personnel performing unexploded ordnance (UXO)-related operations in support of the Department of Defense with the exception of DoD Explosives Ordnance Disposal (EOD) personnel.
- **NOSSA Instruction 8020.15, *Military Munitions Response Program Oversight*.** This document assigns responsibility and establishes procedures and reporting requirements for oversight, review, and verification of the explosives safety aspects of the Navy MRP. This instruction applies to response actions involving military munitions, including UXO, at other than operational ranges.
- **DoD, 2004, 6055.9-STD, *DoD Ammunition and Explosives Safety Standards*, October 5, 2004**. This is the primary DoD regulation that establishes uniform safety standards for ammunition and explosives, associated personnel and property, and unrelated personnel and property exposed to the potential damaging effects of an accident involving ammunition and explosives. It applies for determining minimum safety distances, explosives storage requirements, facility construction and siting (e.g., work sites and magazines), and Explosives Safety Quantity-Distance (ESQD) requirements.
- **DoD, 1991, 4160.21-M, *Defense Materiel Disposition Manual*, and 4160.21-M-1, *Defense Demilitarization and Trade Security Control Manual***. DoD 4160.21-M implements the Federal Property Management Regulation and other laws and regulations applying to the disposition of excess, surplus, and foreign excess personal property. DoD 4160.21-M-1 contains specific guidance for property identified as Munitions List Items (MLI) and Commerce Control List Items. The guidance is applicable for the demilitarization and disposal of MPPH and MD.

- **USACE, 2004, EP 75-1-2,** ***Munitions and Explosives of Concern (MEC) Support for HTRW and Construction Support Activities***. This policy provides USACE personnel with procedural guidance, technical specifications, personnel and training requirements, and health and safety (H&S) criteria for MEC support during HTRW and construction support activities. It applies to all projects for which anomaly avoidance or construction support is necessary because of the potential presence of MEC onsite.
- **USACE, 2000b, EP 1110-1-18,** ***Ordnance and Explosives Response***. This guidance provides the procedures and process to be used to manage and execute all aspects of MEC RAs. It applies to all phases of MEC-related projects.
- **USACE, 2003c, ER 385-1-92,** ***Safety and Occupational Health Requirements for HTRW Waste Activities***. These requirements identify the safety and occupational health documents and procedures that USACE and their contractors are required to developed and implement when they are responsible for executing HTRW- and MEC-related activities.
- **U.S. Army Engineering Support Center, Huntsville (USAESCH), 2004, Engineering Pamphlet (EP) 385-1-95a,** ***Basic Safety Concepts and Considerations for Munitions and Explosives of Concern (MEC) Operations***. This guidance document establishes the safe operating procedures for dealing with MEC items on FUDS, Base Realignment and Closure Act (BRAC) installations, and Installation Restoration Program (IRP) projects. This guidance is applicable for all MEC-related projects.

  In addition, this WP was developed in accordance with the following U.S. Army Corps of Engineers Data Item Descriptions (DID) for MR activities:

  - DID MR-005-01, Type II Work Plan
  - DID MR-005-02, Technical Management Plan
  - DID MR-005-11, Quality Control Plan
  - DID MR-005-13, Investigative Derived Waste Plan

2.2 MEC Contingency Procedures

If MEC is encountered, MCB Camp Lejeune EOD will be contacted for handling and demolition. Neither CH2M HILL nor its subcontractors will handle or dispose of MEC. Therefore, alternatives for disposal are not identified in this WP.

2.3 CWM Contingency Procedures

Based on the documented history of DoD activities at MCB Camp Lejeune and the results of a previous Expanded Site Inspection (ESI) conducted in early 2006, it is not anticipated that chemical warfare materiel (CWM) will be discovered at UXO-04.

If unexpected CWM is encountered, all work will immediately cease. Project personnel will withdraw upwind from the discovery. A team, consisting of a minimum of two personnel, will secure the area to prevent unauthorized access. Personnel will position themselves as far upwind as possible while still maintaining visual security of the area. The Senior UXO

Supervisor (SUXOS) will immediately notify MCB Camp Lejeune EOD, who will be responsible for control of the site and for further notifications.

2.4 Project Organization, Personnel, Reporting, and Schedule

2.4.1 Project Organization

The key organizations involved in this project are NAVFAC, MCB Camp Lejeune, U.S. Environmental Protection Agency (USEPA), North Carolina Department of Environment and Natural Resources (NCDENR), and CH2M HILL. Project execution will be conducted by CH2M HILL and its subcontractors.

2.4.1.1 CH2M HILL – Prime Contractor

As the prime contractor, CH2M HILL is the primary point of contact (POC) with NAVFAC and Camp Lejeune. CH2M HILL will manage the overall project, providing day-to-day project oversight and related program management support to execute the project successfully. CH2M HILL is accountable for meeting the requirements of the work plan and ensuring that the project objectives are met. Project duties controlled by CH2M HILL include:

- Project planning, implementation, and reporting
- Subcontractor selection, management, and control
- Program- and project-level QC
- Program- and project-level health and safety
- Site management
- Technical oversight of subcontractors
- Project closeout

2.4.1.2 USA Environmental, Inc. –Subcontractor

USA Environmental, Inc. (USAE) will provide UXO-trained personnel for the performance of all intrusive activities, including manual excavation at geophysical anomaly locations and the identification of potential MEC. USAE will not perform any MEC handling or demolition operations during this project.

USAE personnel for MEC operations meet the requirements of DDESB TP-18, "Minimum Qualifications for Unexploded Ordnance (UXO) Technicians and Personnel".

2.4.2 Project Personnel

The reporting relationships between key project personnel are illustrated in the organization chart provided as **Figure 2-1**. **Table 2-1** provides contact information for project team members. The roles and responsibilities of the key personnel are discussed below.

- Program Manager—Doug Dronfield will provide program management support of this CTO and will ensure that all contract requirements are met during execution of this project.

- Senior Technical Consultant—Ben Redmond will serve as senior technical consultant and will provide technical reviews on all MEC-related submittals.

TABLE 2-1
Project Personnel Contact Information
Intrusive Investigation Workplan

Name/Title/Organization	Mailing Address	Telephone/Fax/E-mail
Doug Dronfield Program Manager CH2M HILL	13921 Park Center Road Suite 600 Herndon, VA 20171-3241	703-471-1441 (office) 703-471-1508 Doug.Dronfield@ch2m.com
Ben Redmond Senior Technical Consultant CH2M HILL	151 Lafayette Drive Suite 110 Oak Ridge, TN 37830	865-483-9032 (office) 865-384-5511 (cell) 865-481-3541 (fax) Ben.Redmond@ch2m.com
Matt Louth Activity Manager CH2M HILL	5700 Cleveland Street Suite 101 Virginia Beach, VA 23462	757-518-9666 (office) 757-460-4592 (fax) Matt.Louth@ch2m.com
Thomas M. Roth, P.E. Project Manager CH2M HILL	2607 Lavista Road Decatur, GA 30033-1725	404-795-0857 (office) 404-259-6674 (cell) 770-604-9183 (fax) Tom.Roth@ch2m.com
Michael Goldman, C.I.H. Program H&S Manager CH2M HILL	115 Perimeter Center Place NE Suite 700 Atlanta, GA 30346-1278	770-604-9095 (office) 770-604-9183 (fax) Michael.Goldman@ch2m.com
Dan Young, CSP, CRSP Corporate MEC H&S Manager CH2M HILL	10687 Aloe Lane Lillian, AL 36549	251-962-2963 (office) 256-752-0148 (cell) Dan.Young@ch2m.com
Tamir Klaff Program Geophysicist CH2M HILL	490 Marshall Dr Leesburg, VA 20176	703-669-9611 (office) 202-415-9472 (cell) 703-471-1508 (fax) Tamir.Klaff@ch2m.com

- Activity Manager—Matt Louth will coordinate the implementation of all CTOs at MCB Camp Lejeune. Mr. Louth will ensure that information is shared between CTO project teams and will communicate with the LANTDIV Project Manager (PM) concerning the overall MCB Camp Lejeune activity.
- Project Manager—Tom Roth will have overall CH2M HILL responsibility for technical support and oversight, budget and schedule review and tracking, invoice review, personnel resources planning and allocation, and project coordination. Mr. Roth will also coordinate field activities with project field personnel and act as CH2M HILL's primary point of contact with NAVFAC and MCB Camp Lejeune personnel during implementation of this CTO.
- Corporate Munitions Response Safety and QC Officer—Dan Young, CSP, will oversee the implementation of the HASP (refer to Appendix C) and QC Plan (refer to Section 3) to ensure that it meets all specific needs of the project and that appropriate health and safety requirements relative to explosives safety are defined.

- Program Health and Safety Manager—Michael Goldman, C.I.H., will support the implementation of the HASP (refer to Appendix C) to ensure that it meets all specific needs of the project and that appropriate health and safety requirements are defined

- Field Team Leader (FTL) – The FTL will be CH2M HILL's onsite representative to coordinate and oversee the activities of field support personnel and subcontractor personnel. The FTL is also responsible for implementation of and compliance with HASP and QC requirements during the field effort.

- Program Geophysicist—Tamir Klaff will be responsible for ensuring that the QC procedures and objectives for the geophysical reacquisition are implemented and met.

2.4.3 Project Schedule

Modification 4 to CTO-109, which authorizes CH2M HILL to perform the intrusive investigation at Knox Trailer Park, was issued by NAVFAC on July 27, 2006. The schedule for performing the intrusive investigation is provided as Figure 2-6. This schedule will be revised as the project progresses.

2.5 Technical Approach

The technical approach to field operations includes the primary components identified herein. Specific requirements for the activities are identified in the remainder of this chapter.

- Planning
- Site Preparation, consisting of the following sequential activities:
  - Mobilization
  - Grid Reacquisition
- MEC Intrusive Operations, consisting of the following activities:
  - Anomaly reacquisition/detection
  - Manual excavation
  - Anomaly identification and verification
  - Scrap disposal
- Site Restoration and Demobilization

2.6 Planning

The following actions require advanced planning and will be conducted prior to mobilization:

- Finalize procurement actions for items and services needed during the mobilization.

- Hold a pre-mobilization meeting and Operations Readiness Review (ORR) with the project team.

- Coordinate with NAVFAC PM and Base POC on notification to local stakeholders of upcoming project activities.

- Reconfirm site personnel documentation of proper training, certifications, and medical monitoring.

- Coordinate with the NAVFAC PM, Base POC, and subcontractors on the mobilization schedule and activities.
- Coordinate with the MCB Camp Lejeune EOD Safety Specialist for potential emergency support for MEC identification and disposal.

2.7 Site Preparation

The following subsections describe the procedures associated with site preparation, including mobilization of personnel and equipment and the activities required to prepare the site for intrusive activities.

2.7.1 Mobilization

A mobilization period will include identifying, briefing, and mobilizing staff and securing and deploying equipment. Mobilization activities include general activities, establishing a command post, and a kickoff and safety meeting.

2.7.1.1 General Activities

- Identify/procure, package, ship, and inventory project equipment, including geophysical detection equipment, hand tools and supplies, portable toilets, and any other miscellaneous supplies.
- Coordinate with local agencies, including police, hospital, and fire department, as appropriate.
- Coordinate communications with MCB Camp Lejeune EOD and other logistical support.
- Finalize operating schedules.
- Establish MD/non-MEC scrap storage area.
- Organize support facilities and test communication equipment.
- Test and inspect equipment.
- Assemble and transport the work force.
- Conduct site-specific training on the WP, HASP, and MEC procedures and hazards.
- Verify that all forms and project documentation are in order and project team members understand their responsibilities with regard to completion of project reporting requirements.

2.7.1.2 Command Post

- A project command post will be established in an area that is convenient to intrusive activities, but outside the EZs that will be established for intrusive activities.
- A field office equipped with power and communications will be established at the command post. The field office will be the central point of communications for the project and the command location for direction and coordination of intrusive activities at

UXO-04. Personnel will report to this building at the beginning of each workday for the daily H&S briefing. Site documents, including H&S records, will also be maintained in the field office.

- Sanitary facilities will be located at the command post.
- Lockable storage will be provided, either in the field office or in storage trailers, for portable field equipment.

2.7.1.3 Kickoff/Safety Meeting

During mobilization, a kickoff and site safety meeting will be conducted. This meeting will include a review of this WP and review and acknowledgment of the HASP by all site personnel. Additional meetings will occur as needed, as new personnel, visitors, and/or subcontractors arrive at the site.

2.7.2 Grid Reacquisition

The four corners of each grid designated for intrusive investigation will be reacquired. The corners will be marked with wooden or PVC stakes. Each corner stake will be marked with the grid number and the compass direction (NE, SW, etc.) indicating which grid corner is represented.

2.8 MEC Intrusive Operations

This intrusive investigation will be conducted by reacquiring the geophysical anomalies that were identified as possibly representing subsurface MEC within 17 grids in the non-wooded area of the existing Knox Trailer Park. These geophysical anomalies will then be manually excavated to determine the source of each anomaly. The DGM survey identified an average of approximately 600 anomalies per acre that will require intrusive investigation. The map showing the 17 grids is presented as Figure 2-3. Excavation will not be performed in paved roads that pass through the selected grids.

CH2M HILL and its subcontractors will not perform demolition on any MEC items that may be found during the course of this intrusive investigation. MCB Camp Lejeune EOD will take responsibility for handling and demolition of all MEC items.

All geophysical anomalies identified for excavation will be reacquired by a member of the intrusive investigation team to an exact location using Real Time Kinematic (RTK) global positioning system (GPS) and handheld magnetometer. After locating the approximate anomaly position with the GPS, the magnetometer will be used to confirm the exact position of the anomaly. If the anomaly is not immediately intrusively investigated, the location will be flagged. Using a polyvinyl chloride (PVC) flag with the unique identifier number recorded in indelible ink, a location will be flagged one foot north of the actual field location of each reacquired anomaly shown on the tracking sheet.

The 17 grids where anomaly reacquisition and intrusive investigation will be performed were systematically selected to provide coverage across the entire 38 acre non-wooded area of the current Knox Trailer Park.

Excavation of individual DGM anomalies will be performed by qualified UXO technicians using hand-excavation tools or mechanical methods. The UXO team performing this work will be composed of up to five UXO Technicians II or I who are supervised by a Technician III. Details associated with this operation are included in Appendix D (USA Environmental, Inc. MEC Removal SOPs) of this WP.

Small hand tools, such as shovels, spades, trowels, and pry bars, will be used to access potential MEC/MPPEH. The following basic technique will be used for anomaly excavation:

- The UXO technician will investigate within a 1-meter radius of the flagged anomaly with an appropriate geophysical instrument.
- Until identified otherwise, the anomaly is assumed to be MEC. Excavation will be initiated adjacent to the subsurface anomaly. The excavation will continue until the excavated area has reached a depth below the top of the anomaly as determined by frequent inspection with an appropriate geophysical instrument.
- Using progressively smaller and more delicate tools to remove the soil carefully, the excavation team will expand the sidewall to expose the metallic item for inspection and identification without moving or disturbing the item.
- Once the item is exposed for inspection, the excavation team will determine if it is MEC.
- If the item is determined to be MEC, MCB Camp Lejeune EOD will be notified and will be responsible for handling and demolition of the MEC item.
- If the item is not MEC, it will be removed and the area will be rechecked with the appropriate geophysical instrument to ensure that a MEC item was not hidden beneath the removed item. The excavation team will then annotate the results of the excavation on the dig sheet, backfill the hole, and move on to the next marked subsurface anomaly.

2.9 Removal Verification

Following completion of all intrusive activities within a grid, the UXOQCS will select 10 percent% of the anomaly locations at random and check them with a handheld magnetometer to ensure that the anomalies were correctly located and that the source of the anomaly was removed.

2.10 Demobilization

Full demobilization will occur when the project is completed and appropriate QA/QC checks have been performed. Personnel who are no longer needed during the course of field operations may be demobilized prior to the final project completion date. The following will occur prior to demobilization:

- All areas to be investigated will be verified as completed.
- Restoration of the site to an appropriate level will be verified.
- All equipment will be inspected, packaged, and shipped to the appropriate location.

- All facilities-support infrastructures will be dismantled and shipped to the appropriate location, and the field site will be returned to the original condition prior to mobilization.

2.11 Procedures for Reporting and Disposition of MEC and MPPEH Items

This section discusses the procedures for reporting and disposing of MEC and MPPEH items encountered during the project, including the responsibilities of personnel, overall safety precautions, data reporting, transportation, safe holding areas, operations in populated/sensitive areas, demolition operations, and required engineering controls and EZs for intrusive operations and intentional detonations.

2.11.1 Responsibilities of Personnel

The general responsibilities of project personnel are described in Section 2.3.

2.11.2 Overall Safety Precautions

General work practices outlined in USACE EP 385-1-95a, Basic Safety Concepts and Considerations for Ordnance and Explosives Operations (USACE, 2004b), will be followed. Other basic precautions are as follows:

- The work periods for UXO technicians are limited to maximums of 10 hours per day and 40 hours per week.
- The field team will consist of a UXO Technician III and six or fewer team members.

2.11.3 Data Reporting

The collection of accurate and detailed data is essential to documenting the MEC-related activities for future reference. For the excavated bottoms, data for each metallic anomaly will be recorded in the field as intrusive actions are performed. The data will be recorded electronically in the field on mobile data collection devices or by hand (pen and paper) if this is determined to be the most effective method.

A grid data packet will be created for each new grid to be investigated. The UXO Technician III will retain the packet in the grid during clearance activities. Each packet will contain a map showing the location of the grid.

Anomaly tracking sheets will be used to list data for each item encountered and removed. The anomaly tracking sheet will contain the following information:

- Easting Coordinate
- Northing Coordinate
- Depth to Item—Depth to the center of the mass of the item in inches.
- Orientation—Geographical direction (N, S, E, W) the item is pointing, unless vertical.
- Type—Type of ordnance, as specific as possible.

- Date Found—Date on which the MEC item was found.
- Date Disposed of—Date on which the MEC item was disposed of or removed by MCB Camp Lejeune EOD.
- Comments—Any comments of note.

2.11.4 Safe Holding Areas

MEC and/or MPPEH items encountered will be left in place pending response by MCB Camp Lejeune EOD. The location of the item will be marked with caution tape. At least one UXO technician will be assigned as a guard to ensure that no one disturbs the item.

A designated secure area will be established for collection of MD. This area will be locked and will have controlled access.

2.11.5 Exclusion Zones and Separation Distances

Explosives safety quantity-distances include the EZ, team safe separation distance, inhabited building distance (IBD), and public transportation route (PTR) distance. These ESQDs are shown on Table 2-2 and the ESQD arcs are illustrated on Figure 2-2 for an example intrusive operation grid at site UXO-04.

TABLE 2-2
Determining Sizes of Exclusion Zones

Operation	Basis for Determining Size of Exclusion Zone	Minimum Separation Distance (for Nonessential Personnel)	Safe Separation Distance (for Other UXO Teams)	Inhabited Building Distance (IBD)	Public Transportation Route (PTR) Distance
Intrusive Operations	Unintentional Detonation	390 feet *[1]*	200 feet *[2]*	200 feet *[3]*	120 feet *[4]*

[1] Based on theoretical calculated maximum fragment throw distance (horizontal).
[2] Based on minimum separation distance (DDESB TP 16).[3] Based on minimum separation distance (DDESB TP 16).
[4] Based on 60% of IBD.

The ESQD arcs will be established around each grid of active intrusive operations. The ESQD arcs will move around the site as operations commence in each investigation grid. The maximum extents of the ESQD arcs across the operational area are shown on Figures 2-3 through 2-5.

The minimum separation distance (MSD) for all non-essential personnel for an unintentional detonation was determined by selecting the greatest of the following: 200 feet, the K50 distance, or the maximum fragment throw distance for the MGFD described in Section 3.1. Based on the theoretical calculated maximum fragment throw distance (horizontal) for the MK-II HE hand grenade, the MSD is 390 feet per DDESB TP-16.

The safe separation distance for UXO teams was determined by selecting the greater of the following: 200 feet or the K50 (0.9-psi overpressure) distance for the MGFD. The team separation distance is 200 feet.

The (IBD) per DDESB TP-16 is 200 feet. The (PTR) distance is 120 feet, which is 60% of the IBD.

2.12 Scrap and Munitions Debris Disposition

If MEC is encountered during the intrusive investigation, work shall halt, and MCB Camp Lejeune EOD will be contacted to handle and dispose of the recovered MEC. Contact information for this team is included in Section 8. No CH2M HILL personnel or any of their subcontractors will handle MEC or conduct any demolition activities.

The EOD team that will be used for MEC-related technical support and/or emergency response is located at MCB Camp Lejeune. Master Sergeant Gerard McGurty at (910) 449-0558 will serve as the main point of contact if assistance is needed.

Any metallic debris encountered not considered MEC will be collected and stockpiled in a central location on site and segregated as follows:

Group 1 – includes property that previously contained explosives or that does not contain items of a dangerous nature and can be certified inert and or free of explosives or other dangerous materials

Group 1a – includes firing range expended small arms cartridges and inert metals gleaned from cleanup

Group 1b – includes any certifiable material or items not meeting the criteria in 1a above. A determination shall be made as to whether the material or item requires demilitarization. Damage sustained does not necessarily constitute demilitarization.

Group 2 – includes inherently dangerous items that may potentially contain MEC and cannot be certified as inert.

The SUXOS will confirm that non-munitions-related scrap and MD is properly inspected in accordance with DoD standards, including DoD Instruction 4140.62, "Management and Disposition of Material Potentially Presenting an Explosive Hazard (MPPEH)". A UXO Tech III (as defined in Section 3.7) will inspect the MD to assess it for explosives residue and determine whether it is safe to move. If the MD is found to be free of explosive hazards, the UXO Tech III will certify it as such by signing DoD Form 1348-1A. A different UXO Tech III will re-inspect the MD to verify that it is free of explosive hazards, also signing DoD Form 1348-1A.

Once all intrusive activity is finished and all required certifications verifications are complete, the local Defense Reutilization and Marketing Office (DRMO) will be contacted to dispose of scrap metal.

2.13 Recording, Reporting, and Implementation of Lessons Learned during the Project

Documenting and implementing lessons learned are an integral part of every project. During the weekly QC meeting, lessons learned from the preceding week will be shared.

This is also an important aspect of CH2M HILL's Behavior-Based Loss Prevention Program. Lessons learned will also be shared at the daily tailgate meetings with the site personnel. Site personnel will be encouraged to share information of near misses as well as lessons learned.

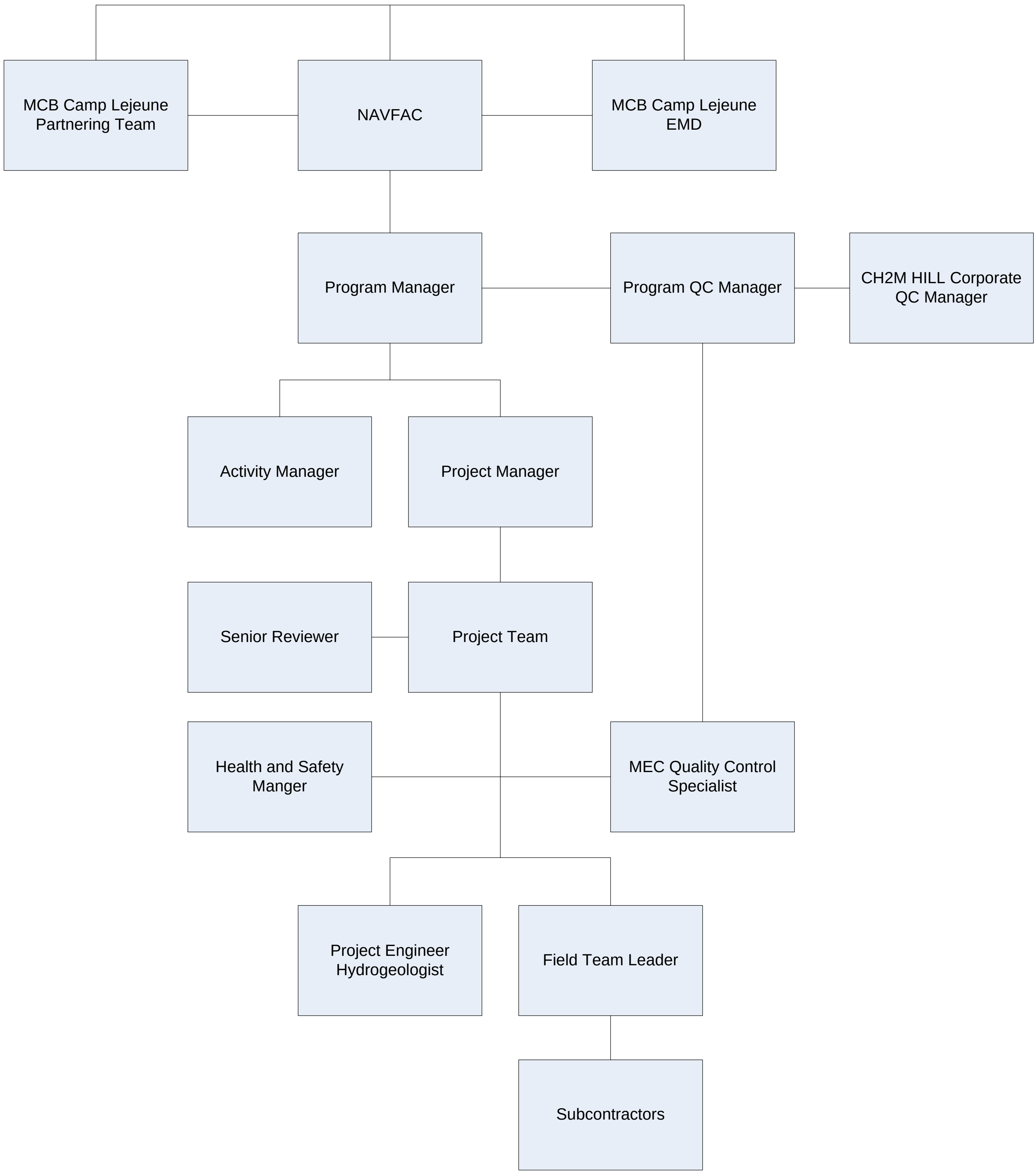
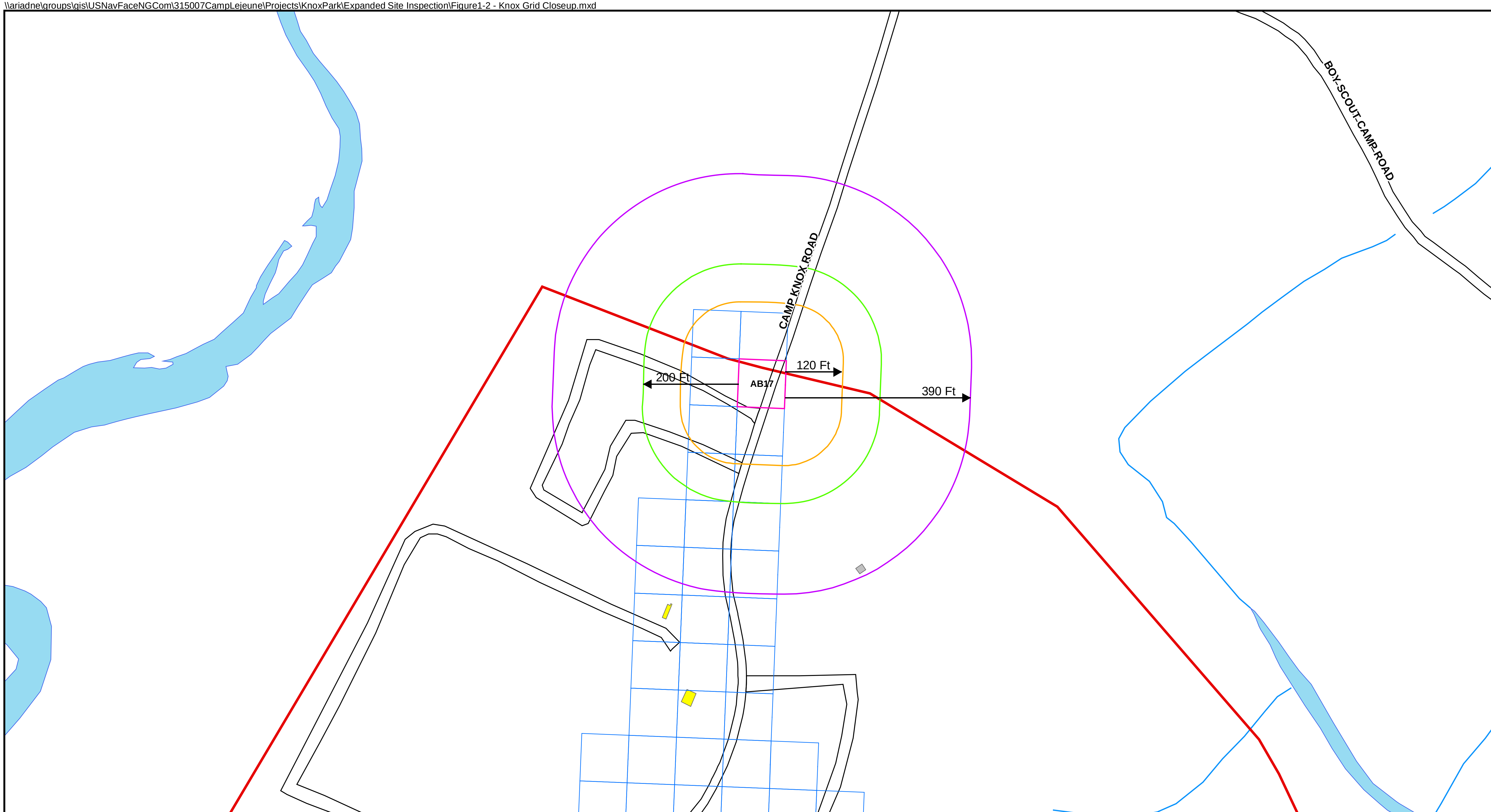


Figure 2-1
Project Team Organizational Structure
Knox Trailer Park, Site UXO-04
Expanded Site Investigation
MCB Camp Lejeune
Jacksonville, North Carolina

CH2MHILL

\\ariadne\groups\gis\USNavFaceNGCom\315007CampLejeune\Projects\KnoxPark\Expanded Site Inspection\Figure1-2 - Knox Grid Closeup.mxd



Legend

- Structure Area
- Road Area
- Surface Water Course Centerline
- Surface Water Body Area
- Site UXO-04
- Towed-Array Grids
- Intrusive Investigation Grids
- Exclusion Zone - 390'
- Inhabited Building Distance (IBD) - 200'
- Public Transportation Route (PTR) - 120'

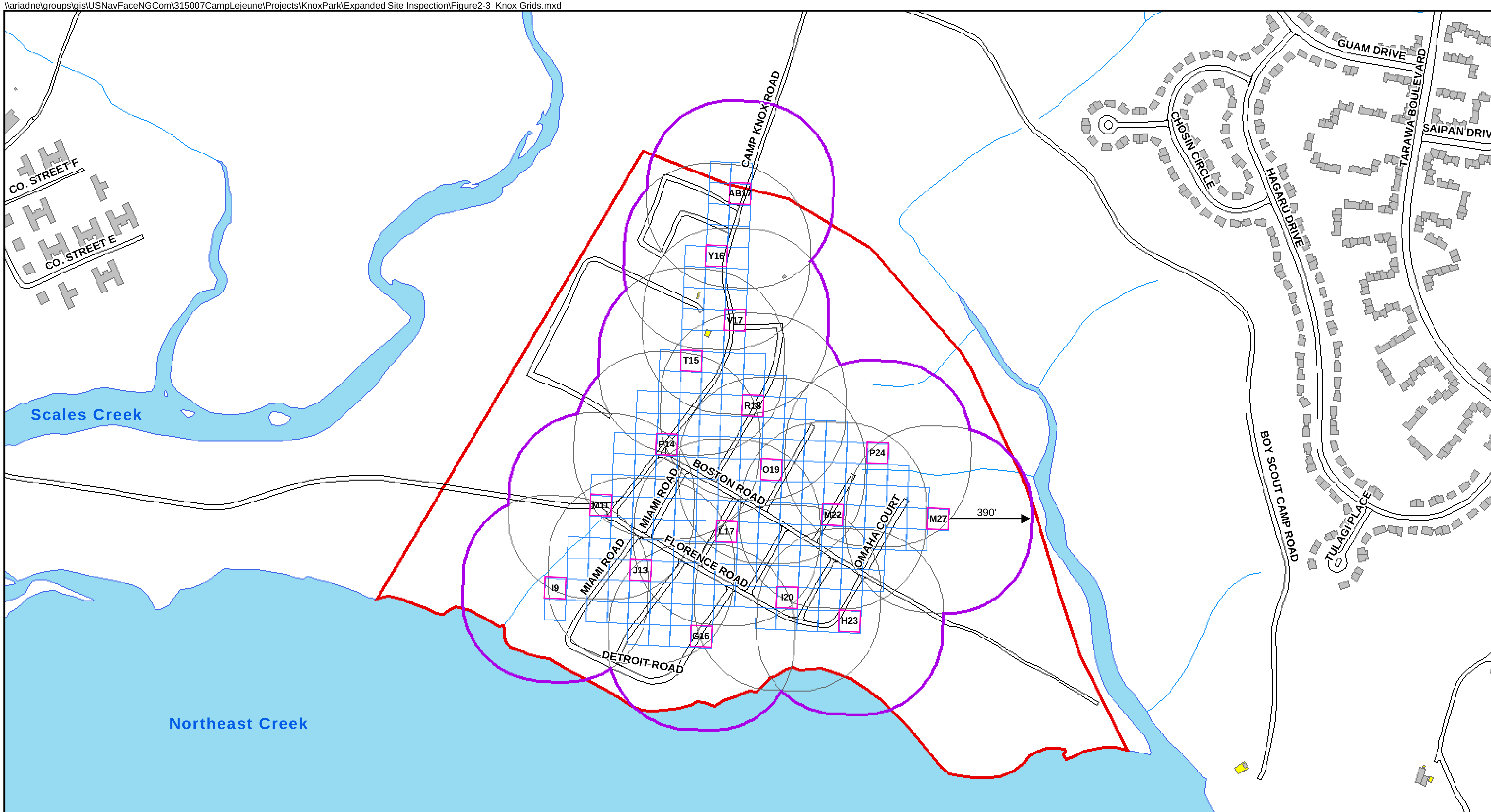
N
W E
S

100 0 100 200
Feet

Figure 2-2
ESQD Arcs for Example Grid
Site UXO-04
Knox Mobile Home Park
MCB Camp Lejeune
North Carolina

CH2MHILL

\\ariadne\groups\gis\USNavFaceNGCom\315007CampLejeune\Projects\KnoxPark\Expanded Site Inspection\Figure2-3_Knox Grids.mxd



Legend

- Structure Area
- Road Area
- Surface Water Course Centerline
- Surface Water Body Area
- Site UXO-04
- Towed-Array Grids
- Intrusive Investigation Grids
- Exclusion Zones
- Exclusion Zone - Maximum Extent

N W E S

225 0 225 450 Feet

Figure 2-3
Exclusion Zone - Maximum Extent
Site UXO-04
Knox Mobile Home Park
MCB Camp Lejeune
North Carolina

CH2MHILL

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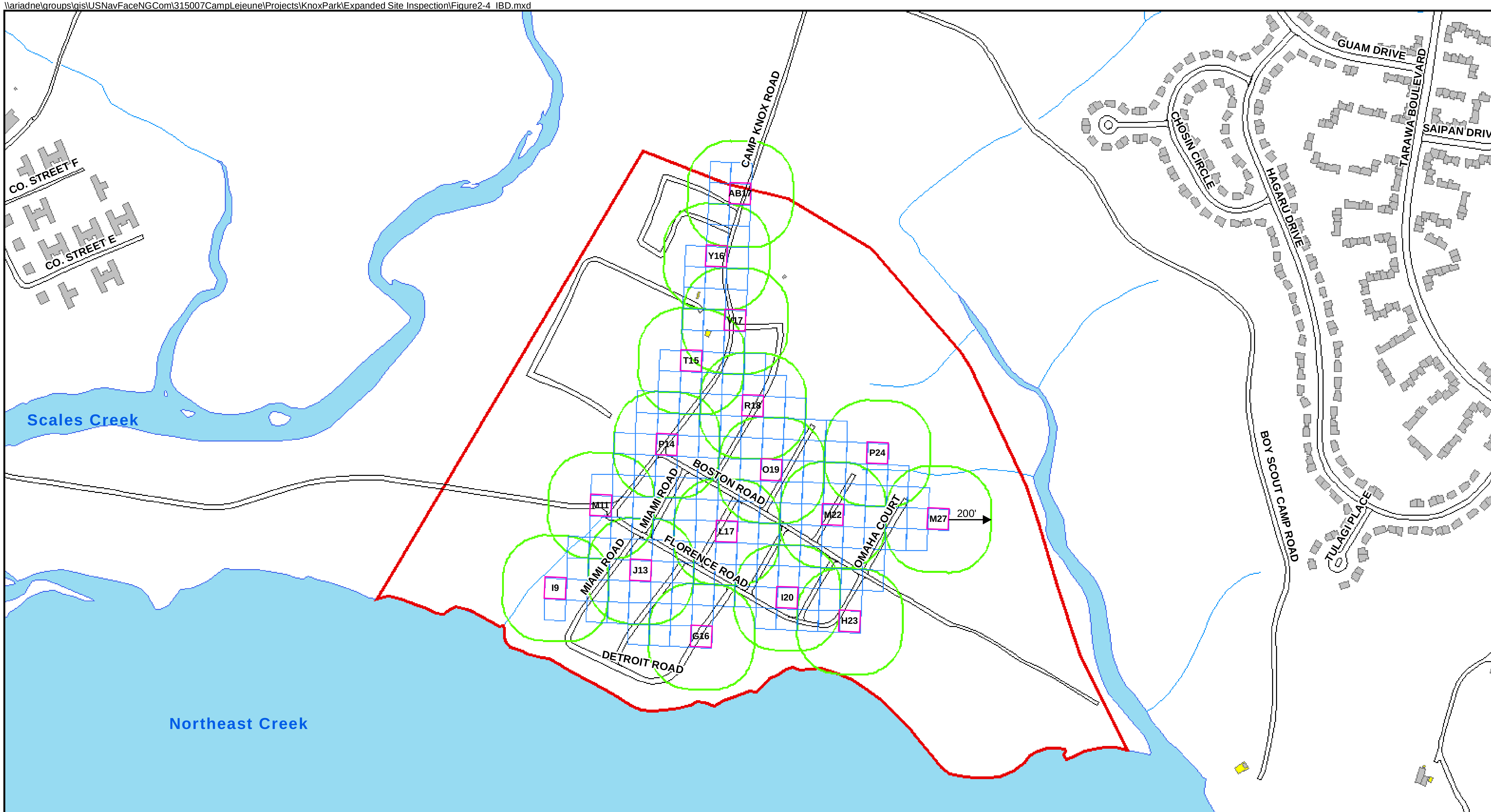


Legend

- Structure Area
- Road Area
- Surface Water Course Centerline
- Surface Water Body Area
- Site UXO-04
- Towed-Array Grids
- Intrusive Investigation Grids
- Inhabited Building Distance (IBD) - 200'

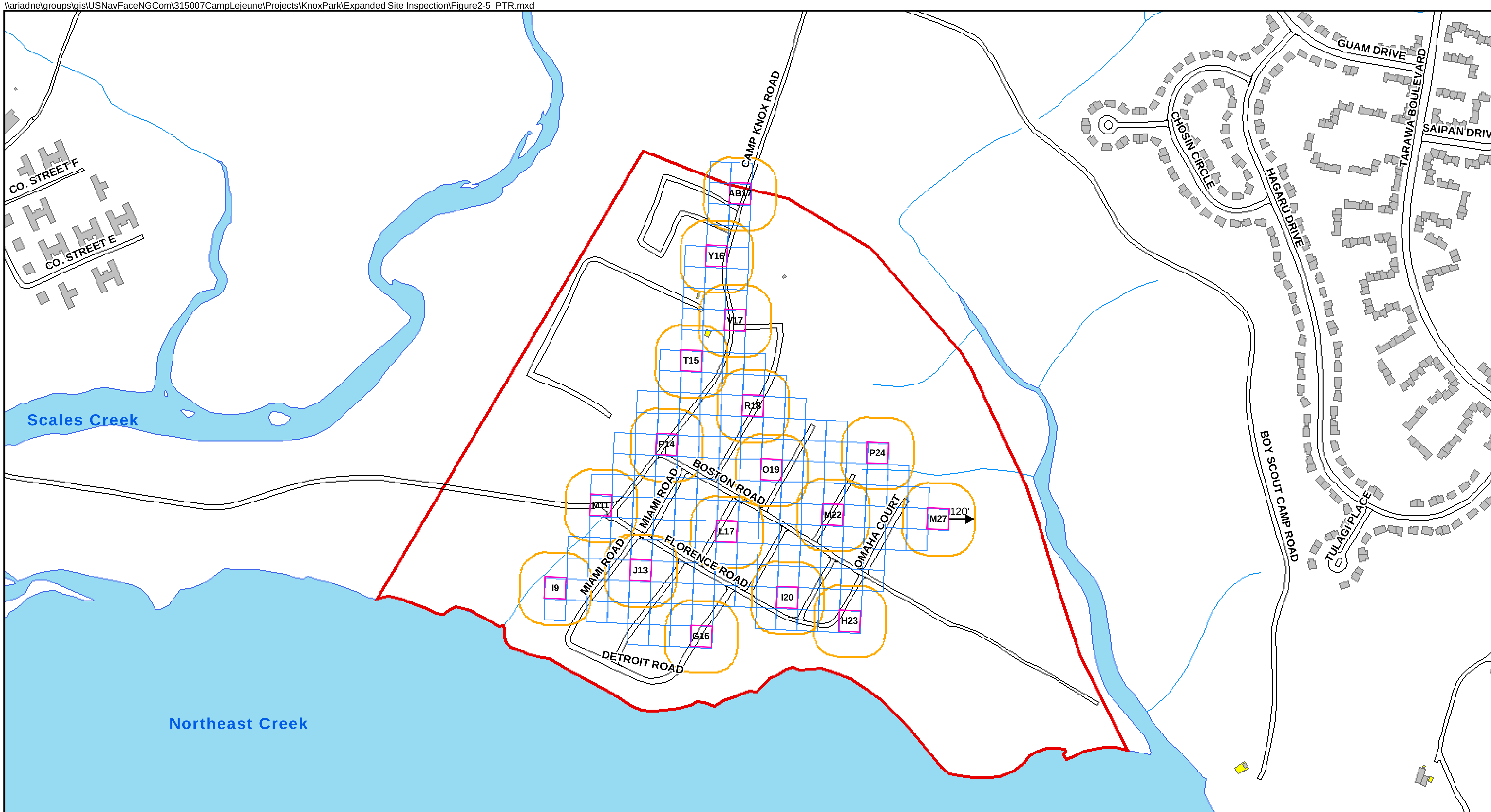
N
W E
S

225 0 225 450
Feet

Figure 2-4
Inhabited Building Distance - Maximum Extent
Site UXO-04
Knox Mobile Home Park
MCB Camp Lejeune
North Carolina

CH2MHILL

\\ariadne\groups\gis\USNavFaceNGCom\315007CampLejeune\Projects\KnoxPark\Expanded Site Inspection\Figure2-5_PTR.mxd



Legend

- Structure Area
- Road Area
- Surface Water Course Centerline
- Surface Water Body Area
- Site UXO-04
- Towed-Array Grids
- Intrusive Investigation Grids
- Public Transportation Route (PTR) -120'

N W E S

225 0 225 450 Feet

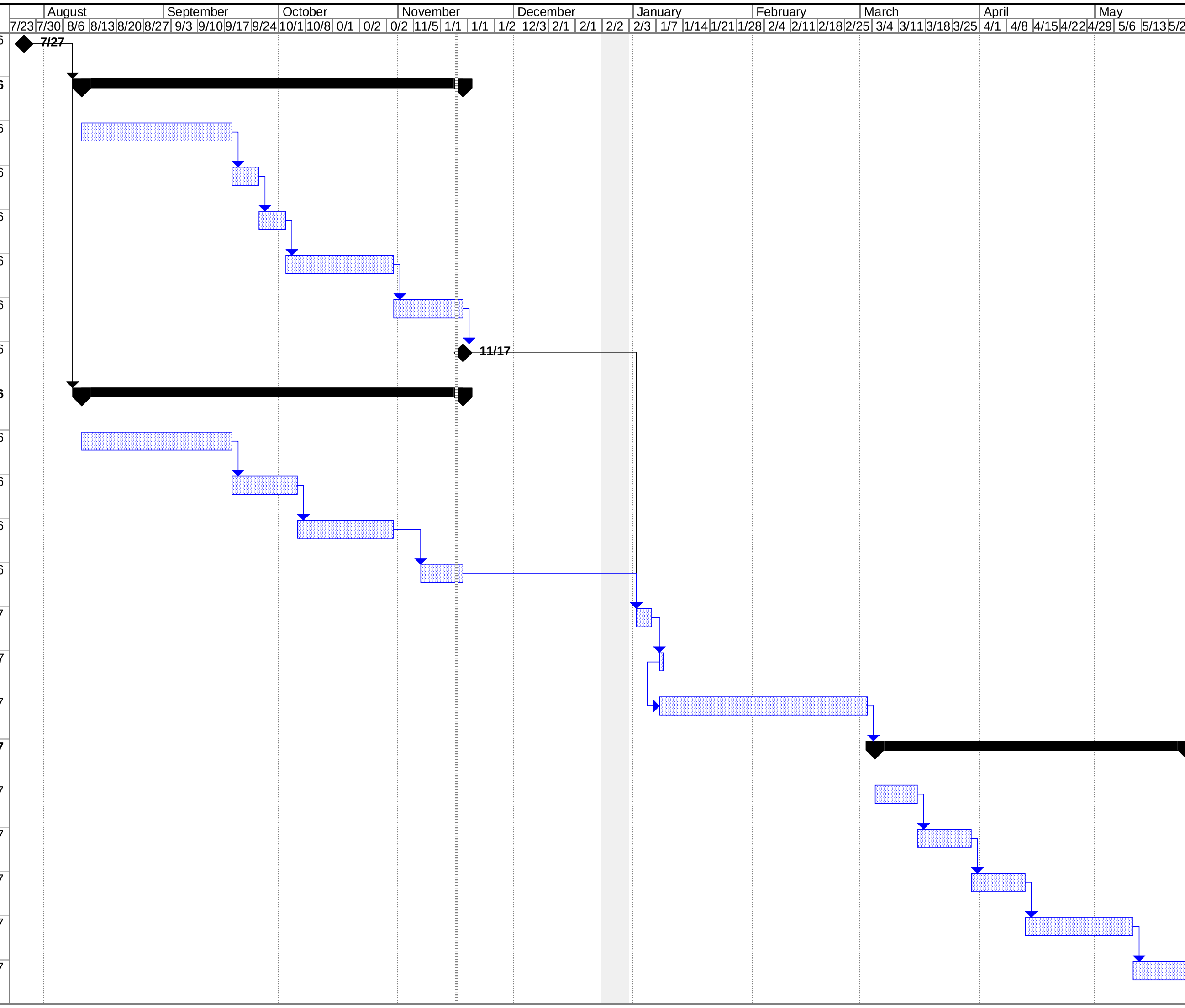
Figure 2-5
Public Transportation Route - Maximum Extent
Site UXO-04
Knox Mobile Home Park
MCB Camp Lejeune
North Carolina

CH2MHILL

Figure 2-6

Intrusive Investigation
MRP Site UXO-04, Knox Trailer Park
MCB Camp Lejeune, NC

ID	Task Name	Duration	Start	Finish
1	Notice to Proceed	0 days	Thu 7/27/06	Thu 7/27/06
2	**Work Plan**	**71 days**	**Fri 8/11/06**	**Fri 11/17/06**
3	Prepare Internal Draft WP	27 days	Fri 8/11/06	Mon 9/18/06
4	Client Review	5 days	Tue 9/19/06	Mon 9/25/06
5	Prepare Draft WP	5 days	Tue 9/26/06	Mon 10/2/06
6	Regulatory Review	20 days	Tue 10/3/06	Mon 10/30/06
7	Prepare Final Work Plan	14 days	Tue 10/31/06	Fri 11/17/06
8	Work Plan Approval	0 days	Fri 11/17/06	Fri 11/17/06
9	**Explosives Safety Submission**	**71 days**	**Fri 8/11/06**	**Fri 11/17/06**
10	Prepare ESS	27 days	Fri 8/11/06	Mon 9/18/06
11	MARSYSCOM Review	13 days	Tue 9/19/06	Thu 10/5/06
12	Revise ESS	17 days	Fri 10/6/06	Mon 10/30/06
13	ESS Approval	9 days	Tue 11/7/06	Fri 11/17/06
14	Mobilization	4 days	Tue 1/2/07	Fri 1/5/07
15	Reacquisition	1 day	Mon 1/8/07	Mon 1/8/07
16	Intrusive Investigation	8 wks	Mon 1/8/07	Fri 3/2/07
17	**Report**	**59 days**	**Mon 3/5/07**	**Thu 5/24/07**
18	Prepare Internal Draft Report	9 days	Mon 3/5/07	Thu 3/15/07
19	Client Review	10 days	Fri 3/16/07	Thu 3/29/07
20	Prepare Draft Report	10 days	Fri 3/30/07	Thu 4/12/07
21	Regulatory Review	1 mon	Fri 4/13/07	Thu 5/10/07
22	Prepare Final Report	10 days	Fri 5/11/07	Thu 5/24/07



Project: Schedule-Intrusive Date: Thu 11/16/06				
Task	Progress	Summary	External Tasks	Deadline
Split	Milestone	Project Summary	External Milestone	

3.0 Quality Control Plan

3.1 Introduction

This QCP describes the QC approach and procedures for intrusive investigation activities at the MCB Camp Lejeune MRP Site UXO-04, Knox Trailer Park. The requirements and systems established in this QCP are relevant and applicable to project work performed by CH2M HILL and its subcontractors.

3.2 Project Organization and Responsibilities

This section identifies key project team members and lists the QA/QC responsibilities associated with each position and describes communication procedures that will be followed throughout the project.

3.2.1 Project Team Members

The organizational structure and responsibilities of the project team (refer to Figure 2-1) are designed to provide project QA/QC for the intrusive investigation activities at the Site UXO-04, Knox Trailer Park. Selected positions are described in the following paragraphs.

3.2.1.1 Project Manager

The PM for this project is Tom Roth. The PM is responsible for overall project activities, including cost control, schedule control, and technical quality. In addition, the PM develops the work plan and monitors task order activities to ensure compliance with project objectives and scope. The PM also communicates with MCB Camp Lejeune and other designated parties regarding project progress.

The PM has ultimate responsibility within the project team for producing deliverables that are technically adequate, satisfactory to the client, and cost-effective. To accomplish this, the PM develops an internal project review schedule, provides written instructions and frequent guidance to the project team, and monitors budgets and schedules. The PM will work with the project team to select an internal QA/QC review team, to coordinate review efforts, to address review comments, and to adjudicate technical issues.

3.2.1.2 Activity Manager

The activity manager (AM) for this project is Matt Louth. The primary objectives of the AM are to build and maintain the relationship with the client and to provide continuity across all projects at MCB Camp Lejeune. The AM will provide overall guidance with regards to NAVFAC and MCB Camp Lejeune and will serve as the alternate CH2M HILL contact. The AM has overall responsibility for client satisfaction.

3.2.1.3 Senior Technical Consultant

The senior technical consultant for this project is Ben Redmond. The senior technical consultant is a company-wide resource with significant experience in the various technical aspects involved in a complex project. The senior technical consultant is responsible for evaluating the technical merit of the work planning documents before field activities begin, and reviewing all deliverables before submittal to MCB Camp Lejeune. The senior technical consultant assists the PM in coordinating review efforts, addressing review comments, and resolving technical issues.

3.2.1.4 Corporate MR Safety and QC Officer

The Corporate MR Safety & QC Officer for this project is Dan Young. The Corporate MR Safety & QC Officer’s responsibilities include, but are not limited to, the following:

- Review and approve the qualifications of proposed UXO staff and UXO subcontractors
- Ensure that the requisite MEC safety records are generated and retained as prescribed in this QCP
- Perform MEC QC audits and surveillance as needed
- Ensure that the responsibilities specific to MR operations are performed by the UXO Technicians.

The Corporate MR Safety & QC Officer will coordinate with the PM and the Site Manager and has authority to enforce the MEC procedures defined in this QCP. The Corporate MR Safety & QC Officer has the authority to stop work to ensure project activities comply with MEC-related specifications of this QCP, the Contract, and the project. This authority applies equally to all project activities, whether performed by CH2M HILL or its subcontractors.

3.2.1.5 Senior UXO Supervisor (SUXOS)

The SUXOS is an employee of the MEC subcontractor USAE and will have responsibility for the execution of all onsite activities in the EZ at Site UXO-04. The SUXOS will be responsible for overseeing scheduling of UXO personnel and ensuring that intrusive activities are performed in accordance with the specified plans. The SUXOS will be familiar with all aspects of H&S as related to MEC and will coordinate with the UXOSO to ensure H&S of site personnel.

3.2.1.6 UXO Safety Officer (UXOSO)

The UXOSO is an employee of the MEC subcontractor USAE and will be responsible for implementing the HASP, inclusive of the MEC-related and general safety components. He will verify compliance with applicable H&S requirements. He will report independently of project management to the CH2M HILL Corporate MR Safety & QC Officer. The UXOSO will implement the approved safety programs in compliance with all DoD, federal, state, and local statutes and codes; analyze operational risks, hazards, and safety requirements; enforce personnel limits and safety EZs for MEC intrusive operations; and conduct safety inspections to ensure compliance with safety codes.

3.2.1.7 UXO Quality Control Specialist (UXOQCS)

The UXOQCS is an employee of the MEC subcontractor USAE and will be responsible for implementing the MEC-related provisions of the project QC program; will conduct QC inspections of all MEC-related operations for compliance with established procedures; and will direct and approve all corrective actions to ensure that all MEC-related work complies with contractual requirements. The UXOQCS will have a direct line of communication with the CH2M HILL PM, Senior Technical Consultant, and Corporate MR Safety & QC Officer.

3.2.1.8 Health and Safety Manager (HSM)

The health and safety manager (HSM) for this project is Mike Goldman. The HSM reviews and approves the project-specific HASP as well as subcontractor HASPs. The HSM serves as the point of contact for the site safety coordinator (SSC) for any health- or safety-related issues, and may conduct project audits. The HSM is also responsible for investigating accidents should any occur during the course of the project.

3.2.1.9 Site Manager

The Site Manager for this project is to be determined. The Site Manager reports to the PM and is responsible for efficiently applying the resources of the project team to execute the field phase of this project. In addition, the Site Manager is responsible for local client interface regarding details of the project and the project team while assigned to the site. The Site Manager will assist the PM in maintaining sufficient resource allocations to meet the project schedule and budget and will provide daily feedback to the PM on project progress, issues requiring resolution, and other project-specific issues, as required.

The quality-related responsibilities of the Site Manager include, but are not limited to, the following:

- Notifying the PM if problems arise with the schedule.
- Providing scheduling and integration of subcontractor services in support of the SUXOS.
- Serving as liaison for communications with project staff and subcontractors, as well as with the onsite client and regulatory agency representatives.
- Providing logistical support for field operations.
- Continuously monitoring work progress and adherence to authorized work scopes, budgets, and schedules.
- Aiding in the preparation of submittals.
- Reviewing the project work plans regularly.

3.2.2 Project Communication

During the field investigation phase of projects, the field teams will meet daily to review the status of the project and to discuss technical and safety issues. When necessary, other meetings will be scheduled or the Site Manager will meet individually with field personnel or the subcontractors to resolve problems. During the field effort, the Site Manager will prepare a weekly report detailing project progress.

During the field effort, the Site Manager will be in regular telephone or face-to-face contact with the project team. When significant problems or decisions requiring additional authority occur, the Site Manager can immediately contact the PM for assistance.

3.3 Definable Features of Work and the Three-Phase Control Process

MEC-related QC will be monitored through the Definable Features of Work (DFOW) using a three-phase control process.

3.3.1 Definable Features of Work

The MEC-related DFOWs for this project are as follows:

1. Mobilization/site preparation
2. Grid reacquisition
3. Utility clearance
4. Anomaly reacquisition and intrusive investigation
5. Demobilization

3.3.2 Three Phases of Control

The UXOQCS is responsible for ensuring that the three-phase control process, consisting of the Preparatory Phase, the Initial Phase, and the Follow-up Phase, is implemented for each MEC-related DFOW listed in this QCP, regardless of whether it is performed by CH2M HILL or its subcontractors. Each control phase is important for obtaining a quality product and meeting the project objectives; however, the preparatory and initial audits are particularly valuable in preventing problems. Production work is not to be performed on a DFOW until successful Preparatory and Initial Phases have been completed.

Preparatory Phase. The Preparatory Phase culminates with the planning and design process leading up to actual field activities. Successful completion of the Preparatory Phase verifies that the project delivery, QC, and safety plans have been completed. The following actions will be performed as applicable for each DFOW:

1. Confirm that the appropriate technical procedures are incorporated into the project work plan and review procedures.

2. Confirm that adequate testing is called for to ensure quality delivery.

3. Confirm definition of preliminary work required at the work site and examine the work area to confirm required preliminary work has been properly completed.

4. Confirm availability of required materials and equipment. Examine materials and equipment to confirm compliance with approved submittals and procedures. Ensure equipment testing procedures are in place, with control limits and frequency, for each piece of equipment.

5. Confirm qualifications/training of personnel and verify roles/responsibilities are well-defined and communicated.

6. Confirm with the HSM and Corporate MR Safety and QC Officer that the site HASP adequately addresses the work operations and those applicable safety requirements have been incorporated into the plan.
7. Discuss methods to be employed during the field activities.
8. Confirm any required permits and other regulatory requirements are met.
9. Verify that lessons learned during previous similar work have been incorporated as appropriate into the project procedures to prevent recurrence of past problems.

Project staff must correct or resolve discrepancies between existing conditions and the approved plans/procedures identified by the PM, SUXOS, and the team during the Preparatory Phase. The PM or designee must verify that unsatisfactory and nonconforming conditions have been corrected prior to granting approval to begin work.

Results of the activity are to be documented in a Preparatory Inspection Checklist specific for the DFOW and summarized in the Weekly QC Report.

Initial Phase. The Initial Phase occurs at the startup of field activities associated with a specific DFOW. The Initial Phase confirms that this QCP, other applicable work plan sections, and procedures are being effectively implemented and the desired results are being achieved.

During the Initial Phase, the initial segment of the DFOW is observed and inspected to ensure that the work complies with contract and work plan requirements. The Initial Phase should be repeated if acceptable levels of specified quality are not met. The following shall be performed for each DFOW:

1. Establish the quality of work required to properly deliver the project in accordance with contractual requirements. The Site Manager will ensure that the field teams are aware of expectations associated with the field methods established under the Preparatory Phase by observing the initial work activities and interacting with the PM, AM, and responsible subcontractors' supervisors.
2. Resolve conflicts. The Senior Technical Consultant will guide the PM and responsible supervisor(s) in resolving conflicts. Should conflicts arise in establishing the baseline quality for the DFOW, the responsibility to resolve the conflict falls to the PM. Should the conflict not be resolved in a manner that satisfies the project requirements, the Senior Technical Consultant must elevate the conflict to the program level and issue a non-conformance report. The Senior Technical Consultant may direct a cessation of work activity with the concurrence of the Corporate MR Safety and QC Officer should the issue jeopardize the results of the DFOW or put the project at risk of non-conformance.
3. Verify with the HSM and Corporate MR Safety and QC Officer that the site HASP was developed to ensure that the identified hazards adequately address field conditions. Confirm that applicable safety requirements are being implemented during field activities.

Upon completion of Initial Phase activities, the results are to be documented in the Initial Phase Inspection Checklist (Form 3-2b at the end of this chapter) and the QC logbook and summarized in the Weekly QC Report. Should results be unsatisfactory, the Initial Phase will be rescheduled and performed again.

Follow-up Phase. Completion of the Initial Phase of QC activity leads directly into the Follow-up Phase, which addresses the routine day-to-day activities at the site. Specific concerns associated with the Follow-up Phase include:

1. Inspection of the work activity to ensure work complies with the Contract and work plans.
2. Evaluation and confirmation that the quality of work is being maintained at least at the level established during the Initial Phase.
3. Evaluation and confirmation that required testing is being performed in accordance with procedures established during the Preparatory Phase and confirmed during the Initial Phase.
4. Confirmation that nonconforming work is being corrected promptly and in accordance with the direction provided by the PM, Site Manager, Senior Technical Consultant, or SUXOS.

To conduct and document these inspections, the Site Manager is to generate the Follow-up Phase Inspection Checklist (Form 3-3b at the end of this chapter). The Follow-up Phase inspections will be performed daily or as otherwise identified in this QCP until the completion of each DFOW.

The UXOQCS is responsible for onsite monitoring of the practices and operations taking place and verifying continued compliance with the specifications and requirements of the Contract, project, and approved project plans and procedures. The UXOQCS is also responsible for verifying that a daily health and safety inspection is performed and documented as prescribed in the HASP (refer to Appendix C to this Work Plan). Discrepancies between site practices and approved plans and procedures are to be resolved and corrective actions for unsatisfactory and nonconforming conditions or practices are to be verified by the UXOQCS or a designee prior to granting approval to continue work. Follow-up Phase inspection results are to be documented in the QC logbook and summarized in the Weekly QC Report.

Additional Audits. Additional audits performed on the same DFOW may be required at the discretion of the Senior Technical Consultant, Corporate MR Safety & QC Officer, SUXOS, HSM, or the PM. Additional preparatory and initial audits are generally warranted under any of the following conditions: unsatisfactory work, changes in key personnel, resumption of work after a substantial period of inactivity (e.g., two weeks or more), or changes to the project scope of work/specifications.

Final Acceptance Audit. Upon conclusion of the DFOW and prior to closeout, the Final Acceptance Inspection must be performed to verify that project requirements relevant to the work are satisfied. Outstanding and nonconforming items are to be documented on the Final Inspection Checklist (Form 3-4b at the end of this chapter). Resolution of each item must be noted on the checklist. Contractor acceptance and closeout of each definable work feature is a prerequisite to project closeout.

3.4 Audit Procedures

The UXOQCS is responsible for verifying compliance with this QCP through audits and surveillance. The UXOQCS or a designee is to inspect/audit the quality of work being performed for the definable feature of work. The UXOQCS or a designee is to verify that procedures conform to applicable specifications stated in this work plan or other applicable guidance. Identified deficiencies are to be communicated to the responsible individual and documented in the QC logbook and Weekly QC Report. Corrective actions are to be verified by the UXOQCS and recorded in the Weekly QC Report.

The Inspection Schedule and Tracking Form (Form 3-5b at the end of this chapter) is to be used by the UXOQCS for planning, scheduling and tracking the progress of audits for this project. The information on the form is to be kept up to date and reviewed by the UXOQCS for planning purposes. Audit activities and corrective actions are to be documented by the UXOQCS in accordance with this chapter. Audit records are to be maintained as part of the project QC file.

3.5 Corrective/Preventive Action Procedures

The corrective and preventive action procedures are designed to prevent quality problems and to facilitate process improvements, as well as identify, document, and track deficiencies until corrective action has been verified.

3.5.1 Preventive Measures

While the entire QC program is directed toward problem prevention, certain elements of the program have greater potential to be proactive. The primary tools for problem prevention on this project are discussed in Three Phases of Control, Submittal Management, and Personnel Qualification and Training sections of this work plan. Should these preventive measures fail, tracking and communicating deficiencies provide a mechanism for preventing their recurrence.

3.5.2 Continual Improvement

Project staff at all levels are encouraged to provide recommendations for improvements in established work processes and techniques. The intent is to identify activities that are compliant but can be performed in a more efficient or cost-effective manner. Typical quality improvement recommendations include identifying an existing practice that should be improved and/or recommending an alternate practice that provides a benefit without compromising prescribed standards of quality. Project staff members are to bring their recommendations to the attention of project management or the QC staff through verbal or written means. However, deviations from established protocols are not to be implemented without prior written approval by the PM and concurrence of the Senior Technical Consultant. Where a staff-initiated recommendation results in a tangible benefit to the project, public acknowledgment is to be given by the PM.

3.5.3 Deficiency Identification and Resolution

While deficiency identification and resolution occurs primarily at the operational level, QC audits provide a backup mechanism to address problems that either are not identified or cannot be resolved at the operational level. Through implementation of the audit program prescribed in this QCP, the QC staff is responsible for verifying that deficiencies are identified, documented as prescribed herein, and corrected in a timely manner. Deficiencies identified by the QC staff are to be corrected by the operational staff and documented by the QC staff.

3.5.4 Corrective Action Request

A Corrective Action Request (CAR) (Form 3-6b at the end of this chapter) can be issued by any member of the project staff, including CH2M HILL and subcontractor employees. If the individual issuing the CAR is also responsible for correcting the problem, then that individual should do so and document the results on Part B of the CAR (Form 3-6b at the end of this chapter). Otherwise, the CAR should be forwarded to the PM, who is then responsible for evaluating the validity of the request, formulating a resolution and prevention strategy, assigning personnel and resources, and specifying and enforcing a schedule for corrective actions. Once a corrective action has been completed, the CAR and supporting information are to be forwarded to the UXOQCS for closure. Sufficient information is to be provided to allow the QC reviewer to verify the effectiveness of the corrective actions.

In addition to observing actual work operations, CARs are to be reviewed during follow-up QC audits. The purposes of this review are as follows: to ensure that established protocols are implemented properly; to verify that corrective action commitments are met; to ensure that corrective actions are effective in resolving problems; to identify trends within and among similar work units; and to facilitate system root cause analysis of larger problems. Particular attention is to be given by the QC staff to work units that generate either an unusually large or unusually small number of CARs.

The PM will determine whether a written Corrective Action Plan (CAP) (Form 3-7b at the end of this chapter) is necessary, based on whether or not any of the following are met: the CAR priority is high; deficiency requires a rigorous corrective action planning process to identify similar work product or activities affected by the deficiency; or deficiency requires extensive resources and planning to correct the deficiency and to prevent recurrence. The CAP is developed by a PM designee and approved and signed by the PM. The CAP is to indicate whether it is submitted for informational purposes or for review and approval. In either event, the operational staff members are encouraged to discuss the corrective action strategy with the QC staff throughout the process. The CAP form is included at the end of this chapter.

3.5.5 Deficiency and Corrective Action Tracking

Each CAR must be given a unique identification number and tracked until corrective actions have been taken and documented in Part B of the form and the CAR is submitted to the PM or a designee for verification and closure.

3.5.6 Lessons Learned and Other Documentation

The lessons learned through the deficiency management process are documented on CARs and CAPs. To share the lessons learned, these documents can be submitted to the Client through a Weekly QC Report summarizing the week's QC activities and including a grouping of the Daily QC Reports (Form 3-8b at the end of this chapter) and all other pertinent reports created during the week.

CARs should be cited in the Weekly QC Report. Minor deficiencies identified during a QC audit that are readily correctable and can be verified in the field are to be documented in the QC logbook and Weekly QC Report without initiating a CAR. Deficiencies that cannot be readily corrected are to be documented by the QC staff on a CAR and in the Weekly QC Report. Copies of CARs are to be referenced in and attached to the Weekly QC Report. CAPs will also be attached to Weekly QC Reports to document the final outcome of the deficiency. Similar or related deficiencies may be addressed on a single CAP.

3.6 Records Generated

3.6.1 Onsite Project File

The Site Manager will establish and maintain an onsite project file in accordance with the CH2M HILL corporate quality manual for document control. The onsite files will be maintained in the project field office or designated field vehicle. The purpose of these files is to maintain a complete set of all documents, reports, certifications, and other records that provide information on project plans, contractual agreements, and project activities.

MRP Enterprise, which consists of a mobile field data collection device used to collect form-based information of DGM operations and a centralized desktop interface and database, will be the repository for most of the information collected by the field team (e.g., daily reports). This database will contain information that can be easily presented and delivered through automated report production, which reduces the amount of actual paper in the files. The database will be backed-up daily and stored in an offsite location as well as in the project trailer. The files (in either paper or digital format) will include copies of the following:

- Qualifications and training records of all site personnel
- Submittals
- Schedule and progress reports
- Survey records
- Conversation logs
- Meeting minutes and agenda
- Audit logs and schedules
- Photo documentation
- Site maps
- Equipment check records
- Nonconformance and corrective action reports
- Daily work activity summary reports, which may include:
  - Weekly QC Report
  - Daily Health and Safety Report
  - Daily Report (including activity log)
  - Equipment check records
  - Incident reports
  - Truck load tickets and shipping papers (if applicable)

As the project activities progress, the Site Manager will monitor the usefulness of the project filing system for information retrieval. If additional file sections are needed, the Site Manager will expand the initial filing structure to include additional sections.

3.6.2 Weekly QC Report

The UXOQCS is responsible for preparing and submitting the Weekly QC Report to the Site Manager, who will incorporate it into a weekly progress report to the PM. The Weekly QC Report is to provide an overview of QC activities performed each day, including those performed by subcontractors. The QC reports must present an accurate and complete picture of QC activities by reporting both conforming and deficient conditions, and the reports should be precise, factual, legible, and objective. Copies of supporting documentation, such as checklists and surveillance reports, are to be attached.

A field QC log is to be maintained by the UXOQCS to document details of field activities during QC monitoring activities. At the end of each day, copies of the log entries are to be attached to the Weekly QC Report. The information in the field QC log provides backup information and is intended to serve as a phone log and memory aid in the preparation of the Weekly QC Report and for addressing follow-up questions.

QC and health and safety staff input for the Weekly QC Report is to be provided in writing to the Site Manager at a previously agreed upon time and place, generally no later than one hour before normal close of business. For the sake of simplicity and completeness, the format for QC staff input should follow the same format as the Weekly QC Report with only the relevant sections completed.

Copies of Weekly QC Reports with attachments and field QC logs no longer in use are to be maintained in the project QC file. Upon project closeout, all QC logs are to be included in the project QC file.

3.7 Personnel Qualifications and Training

All project staff members will be qualified to perform their assigned jobs in accordance with the terms outlined in the Contract and by the project plans. Specific qualifications and training required for UXO-qualified personnel are stated in the following subsections.

3.7.1 Documentation of Qualification and Training for UXO-qualified Personnel

The UXOQCS will maintain records documenting the required qualifications, training, and certifications for each site worker. The UXOQCS will monitor expiration dates to provide advance warning to the PM of when employees will require refresher training or other renewals. The UXOQCS will maintain records of site-specific and routine training for personnel and visitors, as required by this WP. These records will be maintained onsite for audit purposes.

3.7.2 All UXO Personnel

UXO personnel assigned to positions UXO Technician I, UXO Technician II, UXO Technician III, UXO Safety Officer (UXOSO), UXO Quality Control Specialist (UXOQCS), or Senior UXO Supervisor (SUXOS), will be qualified and certified in accordance with NAVSEAINST 8020.9B, Ammunition and Explosives Personnel Qualification and Certification Program; terms outlined by U.S. Department of Labor Employment Standards Administration Wage Hour Division for UXO Personnel; and DDESB TP-18, Minimum Qualifications for Unexploded Ordnance (UXO) Technicians and personnel.

3.7.3 UXO Technician I

In addition to being able to perform all functions of the UXO sweep personnel listed in this section, for this project, UXO Technician I personnel may, with the direction and supervision from UXO-qualified personnel:

- Reconnoiter and classify MEC
- Identify all types of military munitions, including possible fuzes and their condition, armed or unarmed; examples are the following:
  - Bombs
  - Guided missiles
  - Projectiles
  - Rockets
  - Land mines and associated components
  - Pyrotechnic items
  - Military explosives and demolition materials
  - Grenades
  - Submunitions
- Operate personnel decontamination stations

3.7.4 UXO Technician II

In addition to being able to perform all functions of the UXO sweep personnel and UXO Technician I listed in this chapter, for this project, UXO Technician II personnel may:

- Determine precise location in field environment using a variety of techniques such as global positioning equipment or basic land navigation using topographical map and compass
- Perform field-expedient identification procedures to identify contaminated soil
- Perform limited technical supervision of UXO sweep personnel
- Escort personnel who are not directly involved in UXO-related operations (e.g., personnel performing environmental monitoring), but who have activities to perform within exclusion zones
- Inspect material potentially presenting an explosive hazard (MPPEH) for the presence of explosive safety hazards

3.7.5 UXO Technician III

In addition to being able to perform all functions of the UXO Sweep Personnel and for UXO Technicians I and II listed in this chapter, UXO Technician III personnel may:

- Supervise and perform the onsite demil of MEC and handle demolition materials.
- Prepare an explosives storage plan per all applicable guidance.
- Prepare required UXO munitions response actions and/or range maintenance administrative reports.
- Prepare SOPs for onsite munitions responses and/or range clearance activities.
- Conduct daily site safety briefings.
- Supervise the conduct of all onsite UXO-related operations.
- Inspect and certify and/or verify MPPEH as safe or as to the explosive hazard it may present for transfer within DoD or release from DoD control per current policies and standards.

3.7.6 UXO Quality Control Specialist

In addition to being able to perform all functions of the UXO Sweep Personnel, UXO Technicians I, II, and III listed in this chapter, a UXOQCS may:

- Develop and implement the MEC-specific sections of the Quality Control Program Plan (QCPP) for all explosives-related operations.
- Conduct daily audits of the procedures used by UXO teams and individuals for processing MPPEH.
- Conduct QC audits of all explosives operations for compliance with established procedures.
- Identify and verify completion of all corrective actions to ensure all explosives operations comply with requirements.

3.7.7 UXO Safety Officer

In addition to being able to perform all functions of the UXO Sweep Personnel, UXO Technicians I, II, and III listed in this chapter, UXOSOs may:

- Develop and implement approved explosives and MEC H&S program in compliance with applicable DoD policy and federal, state, and local H&S statutes, regulations and codes.
- Analyze operational risks, explosive hazards, and safety requirements.
- Establish and ensure compliance with all site-specific explosives operations safety requirements.
- Enforce personnel limits and safety EZs for explosives-related operations.
- Conduct, document, and report the results of safety inspections to ensure compliance with all applicable explosives safety policies, standards, regulations and codes.

- Ensure all protective works and equipment used within the EZ are operated in compliance with applicable DoD policy, DDESB approvals, and federal, state, and local H&S statutes, regulations and codes.

3.7.8 Senior UXO Supervisor

In addition to being able to perform all functions of the UXO Sweep Personnel, UXO Technicians I, II, and III listed in this chapter, the SUXOS will:

- Plan, coordinate, and supervise all explosives operations;
- Assist in the development of munitions response plans; and
- Supervise multiple teams.

3.7.9 Health and Safety Training

Health and safety training requirements for onsite project personnel have been established in accordance with Occupational Safety and Health Act/Occupational Safety and Health Administration requirements for hazardous site workers (29 CFR 1910.120) and are specified in the HASP, provided as Appendix C to this Work Plan. These training requirements must be met before project personnel can begin site work.

3.8 Testing and Maintenance

Testing and maintenance of equipment such as geophysical instruments, radios, cell phones, vehicles and machinery will be performed per the manufacturer's specifications, this work plan, and all applicable SOPs. Geophysical detection equipment will be tested daily, as specified in the GIP.

Test results must be documented by the individual performing the test. Testing and maintenance records associated with the measuring and testing of equipment must be generated by the individual performing the activity. Documentation for testing and maintenance of equipment is to be made available to the client upon request.

The UXOQCS is responsible for ensuring that the tests are performed and that the results are summarized and provided with the weekly QC report. To track each failing test for future retesting, the failing test must be noted on the deficiency log. Resolution of the failing test is complete when retesting is performed and the corrective action is verified on the deficiency log.

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Form 3-1b

Preparatory Inspection Checklist

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FORM 3-1b

Preparatory Inspection Checklist
(PART I)

Contract No.:

Date: ____________

TITLE AND NO. OF TECHNICAL SECTION: ______________________________

____

____

____

A. Planned Attendees:

Name Position Company

1) ______________________________
2) ______________________________
3) ______________________________
4) ______________________________
5) ______________________________
6) ______________________________
7) ______________________________
8) ______________________________
9) ______________________________
10) ______________________________
11) ______________________________

B. Submittals required to begin work:

Item Submittal No. Action Code

1) ______________________________
2) ______________________________
3) ______________________________
4) ______________________________
5) ______________________________
6) ______________________________
7) ______________________________
8) ______________________________

I hereby certify, that to the best of my knowledge and belief, that the above required materials delivered to the job site are the same as those submitted and approved.

____

Contractor Quality Control Systems Manager

(Continued):

FORM 3-1b

PREPARATORY INSPECTION CHECKLIST
(PART I)

Contract No.:

Date: __________

C. Equipment to be used in executing work:

1) ______________________________
2) ______________________________
3) ______________________________
4) ______________________________
5) ______________________________

D. Work areas examined to ascertain that all preliminary work has been completed:

____
____

E. Methods and procedures for performing Quality Control, including specific testing requirements:

____
____

The above methods and procedures have been identified from the project plans and will be performed as specified for the Definable Feature of Work.

____
Contractor Quality Control Systems Manager

FORM 3-1b

PREPARATORY INSPECTION CHECKLIST
(PART II)

A. Persons in attendance: See Meeting Attendance Sheet (attached)

B. Because of mutual understanding developed during review of preparatory outline and Contract Requirements: (Contract items not specifically covered during the preparatory inspection conference are assumed to be in strict conformance with the contract requirements.)

The items noted above constitute a memorandum of mutual understanding and will be performed as planned and specified.

UXOQCS

Technical Representative

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Form 3-2b

Initial Phase Checklist

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FORM 3-2b

INITIAL PHASE CHECK LIST

Contract No.:

Date: ___________

Title and No. of Technical Section: ____

____

____

Description and Location of Work Inspected: ______________________________________

A. Key Personnel Present:

Name	Position	Company

B. Materials being used are in strict compliance with the contract plans and specifications: Yes ___ No ____

If not, explain: ____

____

____

____

C. Procedures and/or work methods witnessed are in strict compliance with the contract specifications: Yes No ___

If not, explain: ____

____

____

____

D. Workmanship is acceptable: Yes ____ No ____

State where improvement is needed: ____

____

____

____

E. Workmanship is free of safety violations: Yes ____ No ____

If no, corrective action taken:

____

____

____

____

____

UXOQCS

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Form 3-3b

Follow up Checklist

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FORM 3-3b

FOLLOW UP CHECKLIST

Date:
Contractor:
Contract No:

Y=YES; N=NO; SEE REMARKS BLANK=NOT APPLICABLE	
WORK COMPLIES WITH CONTRACT AS APPROVED IN INITIAL PHASE	

IDENTIFY DEFINABLE FEATURE OF WORK, LOCATION, AND LIST PERSONNEL PRESENT

TESTING PERFORMED & WHO PERFORMED TEST (Include number of samples and/or tests taken)

QA Representative________________________ Date _________________

UXOQCS________________________________ Date _________________

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Form 3-4b

Final Inspection Checklist

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FORM 3-4b

FINAL INSPECTION CHECKLIST
(PART I)

DATE: ____________

CONTRACT NO.:____

Project / Area of Inspection: ____

A. DEFINABLE FEATURES OF WORK: Status of Inspection:

I hereby certify, that to the best of my knowledge and belief, that the work inspected is complete and all materials and equipment used and work performed were completed in accordance with plans submitted and approved.

____

CONTRACTOR QUALITY CONTROL SYSTEMS MANAGER

B. Final Acceptance is Approved, Subject to the Correction of the Punchlist Items Below:

(Continued):

FORM 3-4b

FINAL INSPECTION CHECKLIST
(PART I)

DATE:______________________

CONTRACT NO.:

A. Persons in Attendance: See Meeting Attendance Sheet (attached)

B. Resolution of Punchlist Items:

The items noted above constitute a memorandum of mutual understanding and work has been performed as planned and specified.

______________________________ ______________________________

UXOQCS TECHNICAL REPRESENTATIVE

FORM 3-4b

FINAL INSPECTION CHECKLIST
(PART II)

MEETING ATTENDANCE LIST

Meeting:		Date:
Name	**Organization**	**Phone Number**

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Form 3-5b

Inspection Schedule and Tracking Form

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FORM 3-5b

INSPECTION SCHEDULE AND TRACKING FORM

Project:	**Project Manager:**	**UXOQCS:**

Reference Number	Definable Feature of Work	**Preparatory**		**Initial**		**Follow-Up**		**Completion**		
		Date Planned	Actual Date	Date Planned	Actual Date	Planned Begin/End	Actual Dates	Planned Begin/End	Actual Dates	Status

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Form 3-6b

Corrective Action Request

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FORM 3-6b

CORRECTIVE ACTION REQUEST

(2)CAR #:	(3)PRIORITY: ☐HIGH ☐NORMAL	(4)DATE PREPARED:

PART A: NOTICE OF DEFICIENCY

(5)PROJECT:	
(6)PROJECT MANAGER:	(7)UXOQCS:
(8)WORK UNIT:	(9)WORK UNIT MANAGER:
(10)ISSUED TO (INDIVIDUAL & ORGANIZATION):	
(11)REQUIREMENT & REFERENCE:	
(12)PROBLEM DESCRIPTION & LOCATION: (13)CAP REQUIRED? ☐YES ☐NO	(14)RESPONSE DUE:
(15)ISSUED BY (PRINTED NAME & TITLE): SIGNATURE: DATE:	(16)MANAGEMENT CONCURRENCE:

PART B: CORRECTIVE ACTION

(17)PROPOSED CORRECTIVE ACTION/ACTION TAKEN: NOTE: SUPPORTING DOCUMENTATION MUST BE LISTED ON THE BACK OF THIS FORM AND ATTACHED.	
(18)PART B COMPLETED BY (NAME & TITLE): SIGNATURE: DATE:	(19)QC CONCURRENCE:

PART C: CORRECTIVE ACTION VERIFICATION

(20)CAR VERIFICATION AND CLOSE-OUT: (CHECK ONLY ONE & EXPLAIN STIPULATIONS, IF ANY) ☐APPROVED FOR CLOSURE WITHOUT STIPULATIONS ☐APPROVED FOR CLOSURE WITH FOLLOWING STIPULATIONS COMMENTS/STIPULATIONS: (21)CLOSED BY (PRINTED NAME & TITLE): SIGNATURE: DATE:

(1) **UXOQCS**: Verify that the total number of pages includes all attachments.

(2) **UXOQCS**: Fill in CAR number from CAR log.

(3) **UXOQCS**: Fill in appropriate priority category. **High** priority indicates resolution of deficiency requires expediting corrective action plan and correction of deficient conditions noted in the CAR and extraordinary resources may be required due to the deficiency's impact on continuing operations. **Normal** priority indicates that the deficiency resolution process may be accomplished without further impacting continuing operations.

(4) **CAR Requestor**: Fill in date CAR is initiated.

(5) **CAR Requestor**: Identify project name, number, CTO, and WAD.

(6) **CAR Requestor**: Identify Project Manager

(7) **CAR Requestor**: Identify CQC System Manager.

(8) **CAR Requestor**: Identify project organization, group, or discrete work environment where deficiency was first discovered.

(9) **CAR Requestor**: Identify line manager responsible for work unit where deficiency was discovered.

(10) **UXOQCS**: Identify responsible manager designated to resolve deficiency (this may not be work unit manager).

(11) **CAR Requestor**: Identify source of requirement violated in contract, work planning document, procedure, instruction, etc; use exact reference to page and, when applicable, paragraph.

(12) **CAR Requestor**: Identify problem as it relates to requirement previously stated. Identify location of work activities impacted by deficiency.

(13) **UXOQCS**: Identify if Corrective Action Plan (CAP) is required. CAP is typically required where one or more of the following conditions apply: CAR priority is **High**; deficiency requires a rigorous corrective action planning process to identify similar work product or activities affected by the deficiency; or deficiency requires extensive resources and planning to correct the deficiency and to prevent future recurrence.

(14) **UXOQCS**: Identify date by which proposed corrective action is due to QC for concurrence.

(15) **UXOQCS**: Sign and date CAR and forward to responsible manager identified in (10) above.

(16) **Responsible Manager**: Initial to acknowledge receipt of CAR.

(17) **Responsible Manager**: Complete corrective action plan and identify date of correction. Typical corrective action response will include statement regarding how the condition occurred, what the extent of the problem is (if not readily apparent by the problem description statement in [12]), methods to be used to correct the condition, and actions to be taken to prevent the condition from recurring. If a CAP is required, refer to CAP only in this section.

(18) **Responsible Manager**: Sign and date corrective action response.

(19) **UXOQCS**: Initial to identify concurrence with corrective action response from responsible manager.

(20) **UXOQCS**: Check appropriate block to identify if corrective action process is complete so that CAR may be closed. Add close-out comments relevant to block checked.

(21) **UXOQCS**: Indicate document closeout by signing and dating.

Form 3-7b

Corrective Action Plan

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FORM 3-7b

+CORRECTIVE ACTION PLAN

Attach clarifications and additional information as needed. Identify attached material in appropriate section of this form.

PART A: TO BE COMPLETED BY PROJECT MANAGER OR DESIGNEE

(1)PROJECT:		
(2)PROJECT MANAGER:	(3)UXOQCS:	
(4)CAR NO(S) AND DATE(S) ISSUED:		
(5)DEFICIENCY DESCRIPTION AND LOCATION:		
(6)PLANNED ACTIONS	(7)ASSIGNED RESPONSIBILITY	(8) COMPLETION DUE DATE
(9)PROJECT MANAGER SIGNATURE:		DATE:

PART B: TO BE COMPLETED BY UXOQCS OR DESIGNEE

(10)CAP REVIEWED BY:	DATE:
(11)REVIEWER COMMENTS:	
(12)CAP DISPOSITION: (CHECK ONLY ONE AND EXPLAIN STIPULATIONS, IF ANY) ☐ APPROVED WITHOUT STIPULATIONS ☐ APPROVED WITH STIPULATIONS ☐ APPROVAL DELAYED, FURTHER PLANNING REQUIRED COMMENTS:	
(13)UXOQCS SIGNATURE:	DATE:

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Form 3-8b

Daily Quality Control Report

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FORM 3b-8

DAILY QUALITY CONTROL REPORT

Contract No.: __________

Date: ________________Task Order No.:________Report No:_______

LOCATION OF WORK: ____
DESCRIPTION: _____________ ____
WEATHER: (CLEAR) (FOG) (P.CLOUDY) (RAIN) (WINDY)
TEMPERATURE: MIN °F MAX °F

1. Work performed today:

____

____

2. Work performed today by CH2MHILL subcontractor(s):

____

____

____

3. Preparatory Phase Inspections performed today (include personnel present, specification section, drawings, plans, and submittals required for definable feature of work):

____

____

4. Initial phase Inspections performed today (include personnel present, workmanship standard established, material certifications/test are completed, plans and drawings are reviewed):

____

____

5. Follow-up Phase Inspections performed today (include locations, feature of work and level of compliance with plans and procedures):

____

____

____

____

6. List tests performed, samples collected, and results received:

____

____

____

7. Verbal instructions received (instructions given by Government representative and actions taken):

____

____

____

8. Non-conformances/deficiencies reported:

____

____

____

9. Site safety monitoring activities performed today:

____

____

10. Remarks:

____

____

____

____

CERTIFICATION: *I certify that the above report is complete and correct and that I, or my representative, have inspected all work identified on this report performed by CH2M HILL and our subcontractor(s) and have determined to the best of my knowledge and belief that noted work activities are in compliance with the plans and specifications, except as may be noted above.*

UXOQCS (or designee) Signature: ___________________________________

Form 3-9b

Document Review and Release Form

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Client:	Author:	Submittal Register Item No.:	Date:

Document Title:	Revision:	D.O.#	WAD#

Reviewer (*print*)	Reviewer initial & date	Technical	Project Manager	CQC System Mgr.	Health & Safety	Editorial	Chemistry	Construction	Reviewer Comments Resolved (*Signature & Date)*
Same as Technical Reviewer Above		X	Topic outline with objectives for each section submitted prior to Rev. A						

Program Reviewer's Acceptance for Document Submittal	Signature	Yes	No
1) A 4025 (as applicable) prepared and submitted with document?			
2) Technical Conclusions adequately supported by text and data?			
3) Tables and Figures are in the proper format and checked and approved?			
4) The Table of Contents consistent with text information?			
5) Technical Reviewers are qualified and accepted by Technical Manager?			
6) A document Distribution List been prepared and submitted with document?			

Approval: ______________________________
Project Manager

Approval: ______________________________
UXOQCS

Recommended
4025 Code ______________

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4.0 Investigative Derived Waste Plan

The only IDW expected to be generated during intrusive investigation will be scrap that is collected from the ground surface and subsurface while investigating anomalies. Handling and disposal of this scrap and MD is addressed in Section 2.10 of this work plan.

No hazardous waste will be generated during intrusive investigation activities at UXO-04.

Soil excavated during the intrusive investigation will be returned to the excavation and will not be containerized or transported off-site for disposal.

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5.0 References

Cardinell, A.P., S.A. Berg, and O.B. Lloyd, Jr. 1993. Hydrogeologic Framework of U.S. Marine Corps Base at Camp Lejeune, North Carolina. *Water Resources Investigations Report 93-4049*. U.S. Geological Survey.

CH2M HILL. 2005. Final Work Plan for the Expanded Site Investigation, Site UXO-04, Knox Trailer Park, MCB Camp Lejeune, Jacksonville, NC. October.

Department of the Navy. 2005. Revised Pre-Final Environmental Assessment for Privatization of Military Housing at MCB Camp Lejeune, MCAS New River, and MCAS Cherry Point. July.

URS. 2002. Draft Marine Corps Base Camp Lejeune Range Inventory Report. February.

U.S. Army Corps of Engineers. 2001. Final Range Identification and Preliminary Range Assessment, Marine Corps Base Camp Lejeune. Onslow, North Carolina. December.

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APPENDIX A

Geophysical Prove-out Work Plan

Geophysical Proveout Report for the Expanded Site Inspection

Knox Mobile Home Park
MCB Camp Lejeune, NC

Contract Task Order 109
June 2006

Prepared for
Department of the Navy
Atlantic Division
Naval Facilities Engineering Command

Under the
LANTDIV CLEAN III Program
Contract N62470-02-D-3052

Prepared by

CH2MHILL

Virginia Beach, Virginia

Contents

Tables

Figures

Acronyms and Abbreviations

CTO	Contract Task Order
DGM	Digital Geophysical Mapping
DID	Data Item Description
DQO	Data Quality Objective
ft	Feet
FTP	File Transfer Protocol
GPO	Geophysical Prove-Out
GPS	Global Positioning System
in.	Inch
m	Meter
MEC	Munitions and Explosives of Concern
mm	Millimeter
MR	Munitions Response
mV	Millivolts
QC	Quality Control
RAC	Remedial Action Contract
RTK	Real-Time Kinematic
SUXOS	Senior UXO Supervisor
µs	microseconds

1.0 Introduction

CH2M HILL conducted an Expanded Site Inspection (ESI), including digital geophysical mapping (DGM), at Munitions Response Program (MRP) Site UXO-04, Knox Mobile Home Park, Marine Corps Base (MCB) Camp Lejeune, North Carolina. This ESI was conducted for the Department of the Navy, Naval Facilities Engineering Command (NAVFAC), Atlantic Division (LANTDIV), under the LANTDIV Comprehensive Long-Term Environmental Action Navy (CLEAN) III Program. This work was performed under Contract Task Order 109 (CTO-109) of Contract No. N62470-02-D-3052.

The DGM effort was conducted by NAEVA, Inc., under subcontract to CH2M HILL, and included a geophysical proveout (GPO) as an element of the DGM quality assurance/quality control (QA/QC) program. This Geophysical Prove-out (GPO) Report documents the GPO activities performed between December 6 and December 8, 2006, as part of the process for validating the DGM systems to be utilized during the geophysical surveys.

2.0 GPO Objective

The primary objective of the GPO was to demonstrate and document the site-specific capabilities of the selected DGM systems to operate as an integrated system capable of meeting project data quality objectives (DQOs). For the purposes of this work, a system is considered to include the survey platform, sensors, navigation equipment, data analysis and management, and associated equipment and personnel.

3.0 Equipment

Because DGM surveys have been effectively performed under similar site conditions using the Geonics™ EM61, it was determined that only an EM61 based systems would be verified for use in the GPO. The following two systems were tested:

- 2-Coil EM61 Towed Array - The EM61 towed array tested during the GPO is a system of two ½-m x 1-m EM61-MK2 coils linked to an RTK GPS for data positioning. The sensor height above the ground surface was tested at approximately 0.35 m (1.15 ft) above ground surface. The sensors were towed by an all-terrain vehicle.
- Single-coil Man-Portable EM61 - The single-coil man-portable EM61 tested during the GPO is a standard ½ x 1 m EM61-MK2. Because the single-coil EM61-MK2 system was to be used in areas where vegetation (trees) prevented the use of a towed system and vegetation canopy prevented the use of GPS, the positioning was performed using a fiducial method.

The EM61-MK2 utilizes the electromagnetic induction technique. This technique uses an active sensor that induces currents in conductive objects near the instrument that are measured by a receiving coil to detect both ferrous and non-ferrous items. Photographs of the systems used in the GPO are presented as Figure 1.

Figure 1. EM61-MK2 systems tested (array and single-coil)

4.0 Procedures

This section presents a summary of the procedures followed during the GPO.

4.1 Test Grid Location, Screening and Construction

The approximate GPO grid location was selected by the project team at an onsite location having a minimal amount of metallic debris. The CH2M HILL Munitions Response (MR) Geophysicist then selected a specific 40 ft x 200 ft plot and the grid corners were surveyed by a North Carolina Registered Professional Land Surveyor. The location of the GPO is shown on Figure 2.

After the GPO plot was selected, the DGM subcontractor, NAEVA Geophysics, Inc., performed a background DGM survey to document existing anomalies and to make a final determination as to whether the location could be used as the GPO.

After pre-processing the background DGM data, the data files were given to the CH2M HILL MR Geophysicist. (NAEVA was instructed not to grid or view the actual background data.) The data were then further processed by the CH2M HILL MR Geophysicist and displayed in Geosoft Oasis Montaj™ for onsite analysis by CH2M HILL technical personnel. A map of the background DGM results is presented as Figure 3. Many anomalies were present in the GPO area; however, it was determined that the area could be effectively used for the GPO and NAEVA personnel remained clear of these locations during GPO seed items placement.

CH2M HILL personnel selected seed item locations within the GPO plots. A UXO Technician then screened the locations with a Schonstedt magnetometer, and the team excavated holes in which to place the seed items. The holes were backfilled after the seed items were placed.

Seed items consisted of simulated MK2 grenades (2″ x 4″ steel pipes), placed at the location shown on Figure 4. After digging the holes, the labeled items were positioned at the depths and orientations shown in Table 1. The items were placed such that the distance from the approximate ground surface (as indicated by placing the handle of a shovel from one side of the hole to the other and measuring from its base) to the topmost point on the seed item was equal to the depth (measured using a metallic tape measure) in the table.

Once the items were positioned in the holes, a professional land surveyor proceeded to survey the locations (easting, northing) of the items. Table 1 contains the positioning data collected by the surveyor. After the professional land surveyor completed the survey of the items, each hole was backfilled and the ground surface returned as close as possible to the original elevation. Figure 4 is an as-built of the plot showing the locations of all of the seed items.

Table 1. GPO Seed Items

ID	Ordnance Type	Depth (in.)	Orientation	Direction	Easting	Northing
GPO-1	MK2 Grenade	6	Horizontal	North-South	361902.5	2483492.9
GPO-2	MK2 Grenade	12	Horizontal	North-South	361915.2	2483492.7
GPO-3	MK2 Grenade	18	Horizontal	North-South	361915.3	2483500.2
GPO-4	MK2 Grenade	22	Horizontal	North-South	361919.0	2483507.8
GPO-5	MK2 Grenade	24*	Horizontal	North-South	361929.6	2483507.6
GPO-6	MK2 Grenade	6	Vertical	Not Applicable	361929.0	2483499.5
GPO-7	MK2 Grenade	12	Vertical	Not Applicable	361936.0	2483489.1
GPO-8	MK2 Grenade	18	Vertical	Not Applicable	361939.4	2483497.8
GPO-9	MK2 Grenade	22	Vertical	Not Applicable	361938.7	2483515.5
GPO-10	MK2 Grenade	24*	Vertical	Not Applicable	361944.4	2483508.9
GPO-11	MK2 Grenade	6	Horizontal	East-West	361950.8	2483501.5
GPO-12	MK2 Grenade	12	Horizontal	East-West	361961.1	2483522.7
GPO-13	MK2 Grenade	18	Horizontal	East-West	362040.1	2483505.9
GPO-14	MK2 Grenade	22	Horizontal	East-West	362043.0	2483494.9
GPO-15	MK2 Grenade	24*	Horizontal	North-South	361910.3	2483525.4

Notes:
Coordinates in NAD83, North Carolina State Plane, U.S. Survey Feet
**Item is deeper than DQO required depth*

4.2 DGM Surveys

After seeding was completed, NAEVA performed a DGM survey over the GPO plot with each system using the same procedures as intended for the surveys of the project site. The data sets were processed, interpreted and anomaly selections made by NAEVA prior to transfer of the data to CH2M HILL's MR Geophysicist for review and further analysis. Raw and processed geophysical data and a target selection spreadsheet ("dig sheet") were delivered by NAEVA to the CH2M HILL MR Geophysicist within 24 hours of data collection using the file formats specified in the project work plan.

5.0 Data Processing and Interpretation

Processing steps used by NAEVA are discussed in this subsection.

5.1 Data Processing

Instrument-specific software (Geonics' DAT61-MK2™) was used for initial data processing and the output was imported into Geosoft Oasis Montaj™ for additional processing, graphical display, anomaly selections and QC. General processing steps performed on the data included the following:

- Positional offset correction

- Sensor bias, background leveling and/or standardization adjustment
- Sensor drift removal
- Latency correction
- Contour level selection with background shading

5.2 Interpretation/Anomaly Selection

Geophysicists, experience in the processing of data from munitions and explosives of concern (MEC) sites, used the following criteria for selecting and locating anomalies:

- Automatic target picking on Channel 2 (366 µs time gate) using Blakely test (Smoothing passes = 3, Peak detection = Normal, Grid cutoff level = 3).
- Manual removal of all anomalies where multiples exist. (Keeping the one closest to the center or primary peak of the anomaly.)
- Manual review of the data to add or remove anomalies at the discretion of the data processor.

6.0 Results and Analysis

During the GPO data collection activities, the CH2M HILL MR Geophysicist observed the geophysical detection instruments operating in NAEVA's configurations, using NAEVA personnel and methodologies. All data collection was consistent with documented procedures and met project DQOs.

6.1 Background DGM Survey

A discussion of the results of the background DGM survey was presented in Section 4.1.

6.2 DGM Surveys over Seeded GPO Plot

Figures 5, 6 and 7 present the graphical results of the DGM surveys over the seeded GPO plot. Because of the predominance of pre-existing anomalies in the central area of the grid, NAEVA was asked to select anomalies only in the lower and upper sections of the plot, where the seed items were planted in areas without existing anomalies. CH2M HILL has performed an analysis on the DGM data collected and a summary of the DQOs and results are presented in Table 2.

CH2M HILL's analysis indicates that all DQOs outlined in the project Work Plan were met during the GPO. It should be noted that reacquisition of the selected anomalies was not performed during the GPO because reacquiring anomalies at the site was not anticipated; however, should this operation be planned at any time in the future the subcontractor performing reacquisition will be asked to demonstrate that they can meet the reacquisition DQO prior to performing the activity. It should also be noted that because of the site-wide level of metallic contamination and the presence of anomalies in the background survey of the GPO plot, the high number of anomalies selected in the plot with respect to the actual number of seed items planted is a result of existing anomalies and not equipment or process failure.

TABLE 2
Summary of GPO Results with Respect to Project Data Quality Objectives

Data Quality Objective	Measurement Performance Criteria	Test Method During GPO
General System Functioning		
Accurate coordinates are being obtained from DGM positioning systems.	Positional error at known monuments will not exceed ±20 cm.	DQO Met
Repeatable data are being obtained from DGM system.	Response to standardized item will not vary more than ±20%.	DQO Met
DGM Surveys		
DGM survey system can detect all MEC to the depths specified by the following equation: Estimated Detection Depth (meters) = 11*diameter (mm) / 1000 (Depth is to top of the item.)	Sensor to identify 100% of all MEC items (or their surrogates in the GPO) at depths fitting within the detection depth equation.	DQO Met
Downline data density is sufficient to detect MEC items.	Over 98% of possible sensor readings are captured along a transect. In addition, any transect containing a data gap of 2 ft or greater does not meet the DQO.	DQO Met
Coverage over survey area is sufficient to detect MEC items.	Search transect spacing to vary no more than ±20% of spacing specified in sampling design.	DQO Met
Positioning of detected anomalies is accurate.	95% of all anomaly locations (as shown on the dig sheets) lie within a 1-meter radius of a point on the ground surface directly above the source of the anomaly.	DQO Met
Data Handling		
All data must be delivered in a timely manner and in a useable format.	Data packages are completed and delivered to the CH2M HILL Project Geophysicist within 1 working day of data collection.	DQO Met

7.0 Quality Control

NAEVA was observed collecting data to comply with all of the GPO Plan QC requirements. All documented QC tests were checked for DQO compliance (as specified in the GPO Work Plan) and each test was within those requirements. Documentation for each test is provided in the Results of Geophysical Investigation Report (NAEVA Geophysics, March 28, 2006).

8.0 Conclusions

A GPO plot was established at the Knox Park site for use in the validation of DGM systems for performing DGM surveys of the Knox Park site. After CH2M HILL prepared the GPO plot by seeding targets representative of potential MEC at the site, NAEVA personnel performed a survey over the plot and the data were processed and interpreted.

Based on the results of the GPO, it was established that the system met project DQOs and the system was considered validated and appropriate for use at the site.

Figure 3. Background EM61-MK2 Survey Results

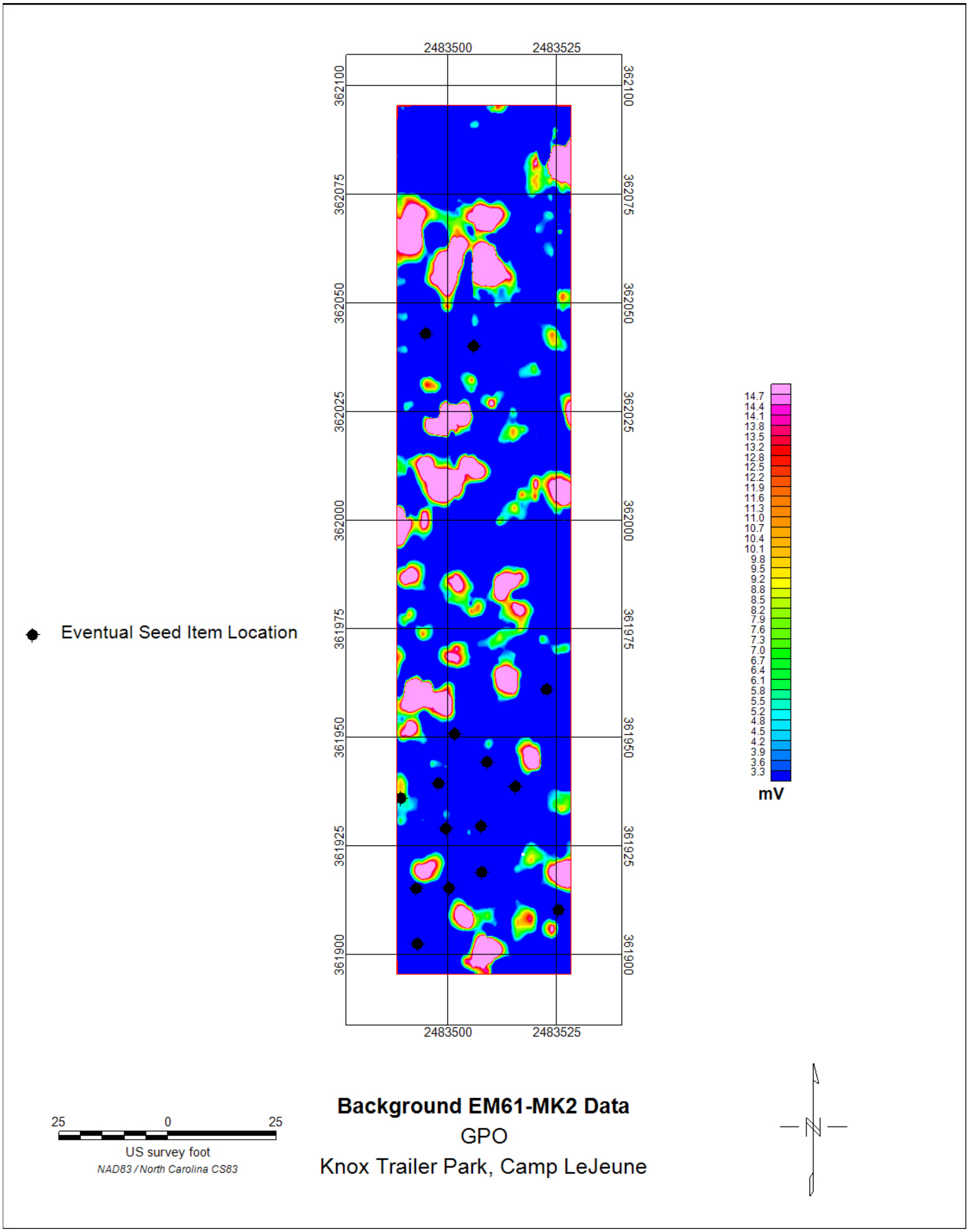


Figure 4. Geophysical Prove-out As-Built Map

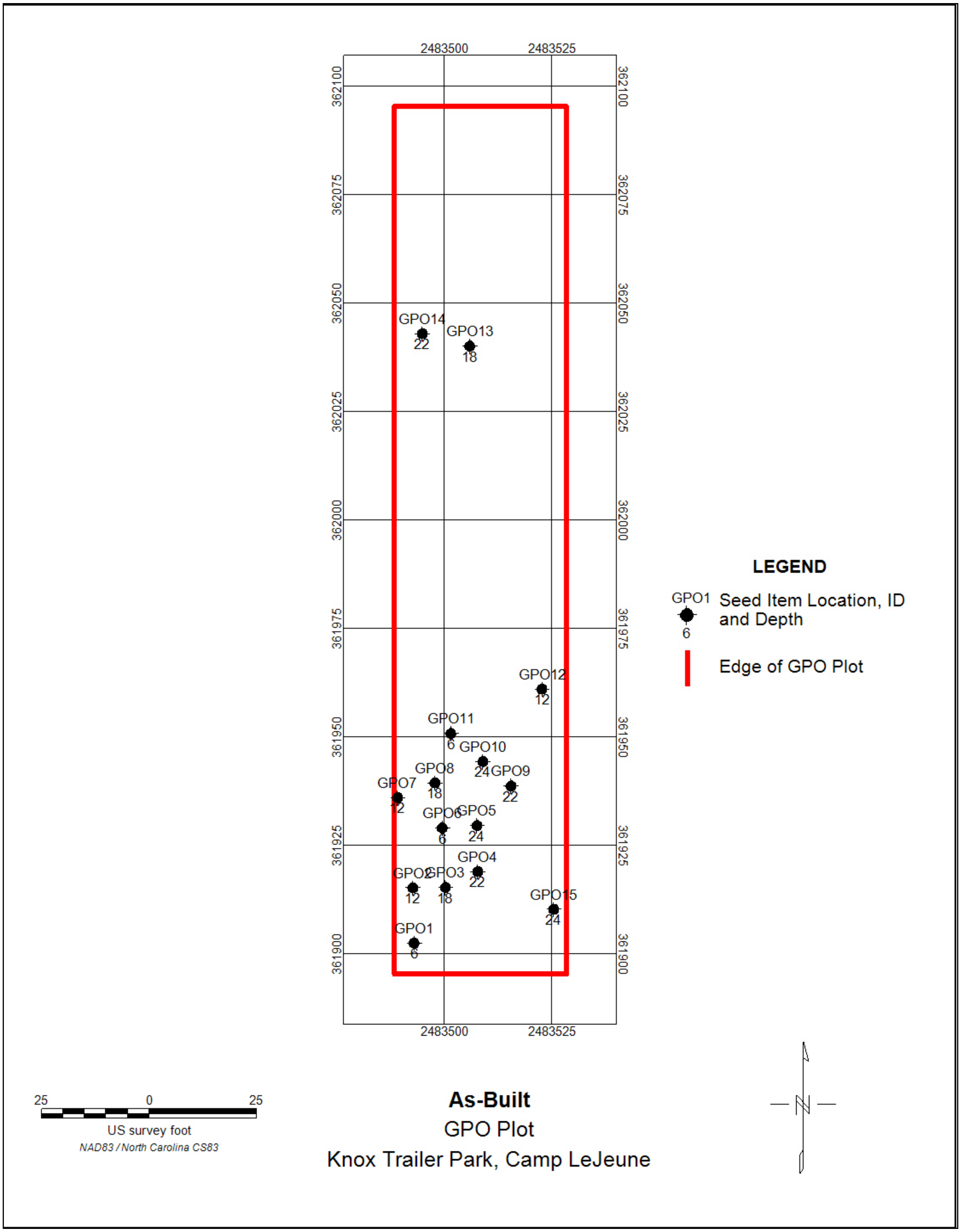


Figure 5. NAEVA Map of EM61-MK2 Array Survey Results - Seeded GPO Plot (Location of Seed Items added to Map by CH2M HILL)

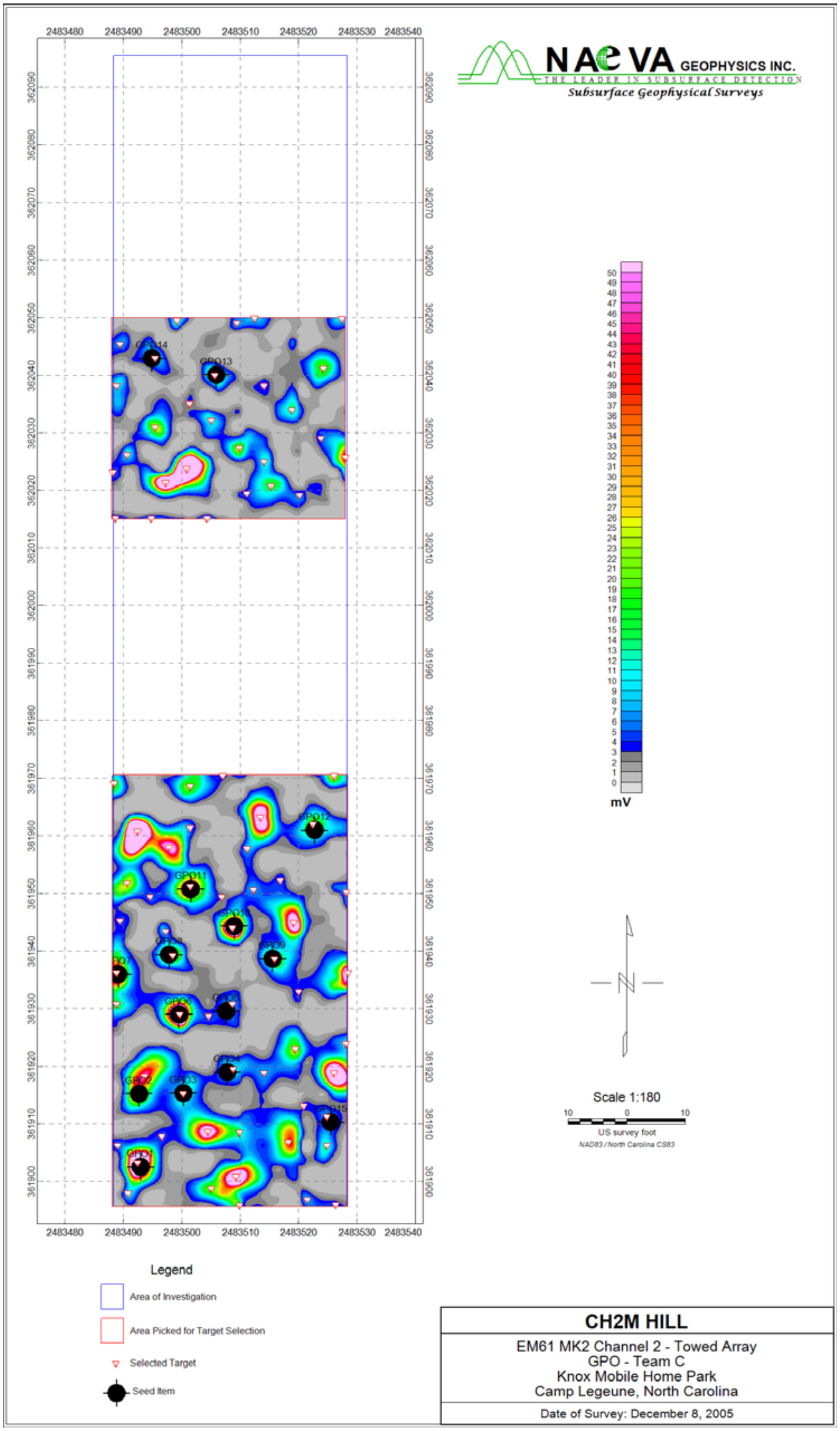


Figure 6. NAEVA Map of EM61-MK2 Single Coil A - Seeded GPO Plot (Location of Seed Items added to Map by CH2M HILL)

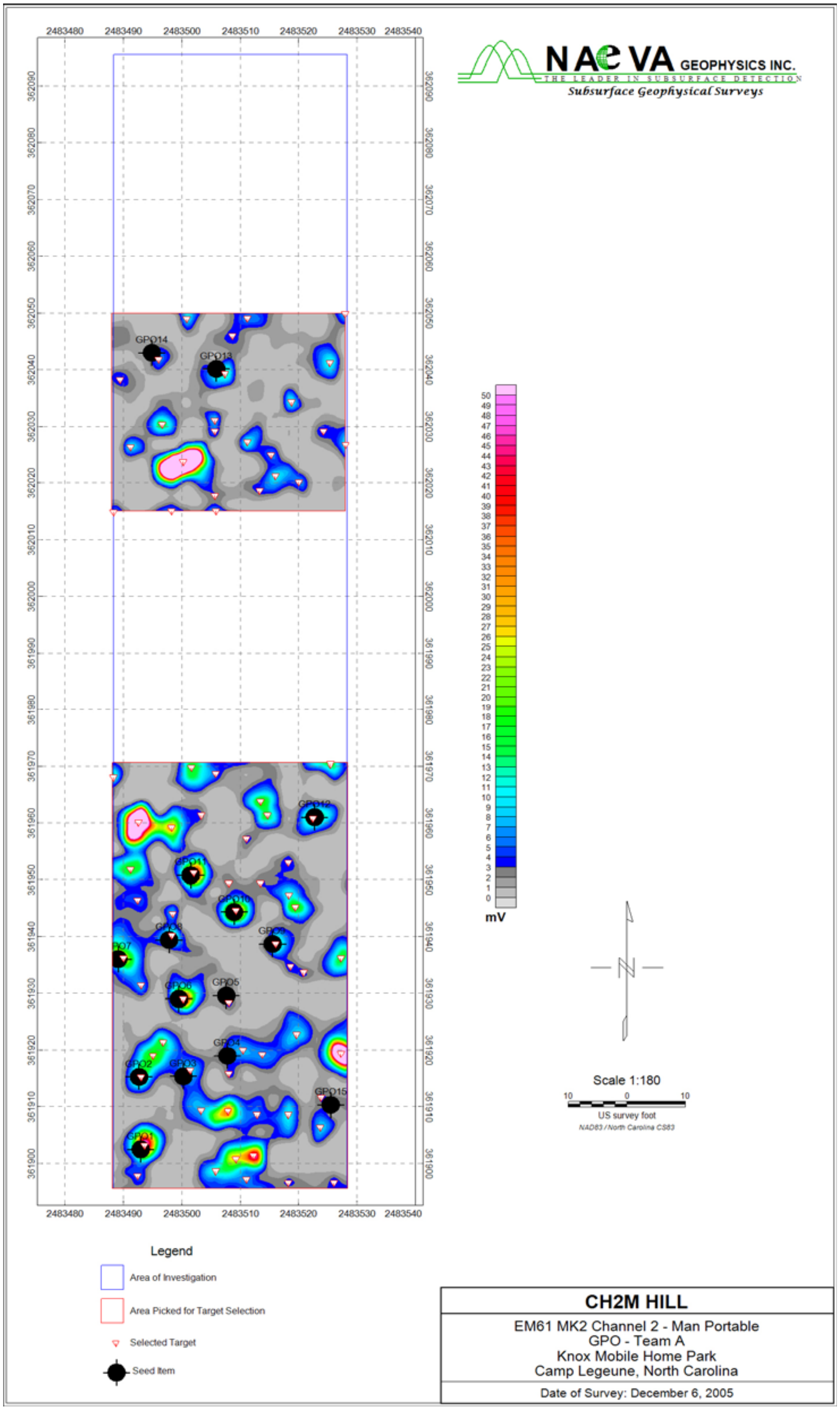
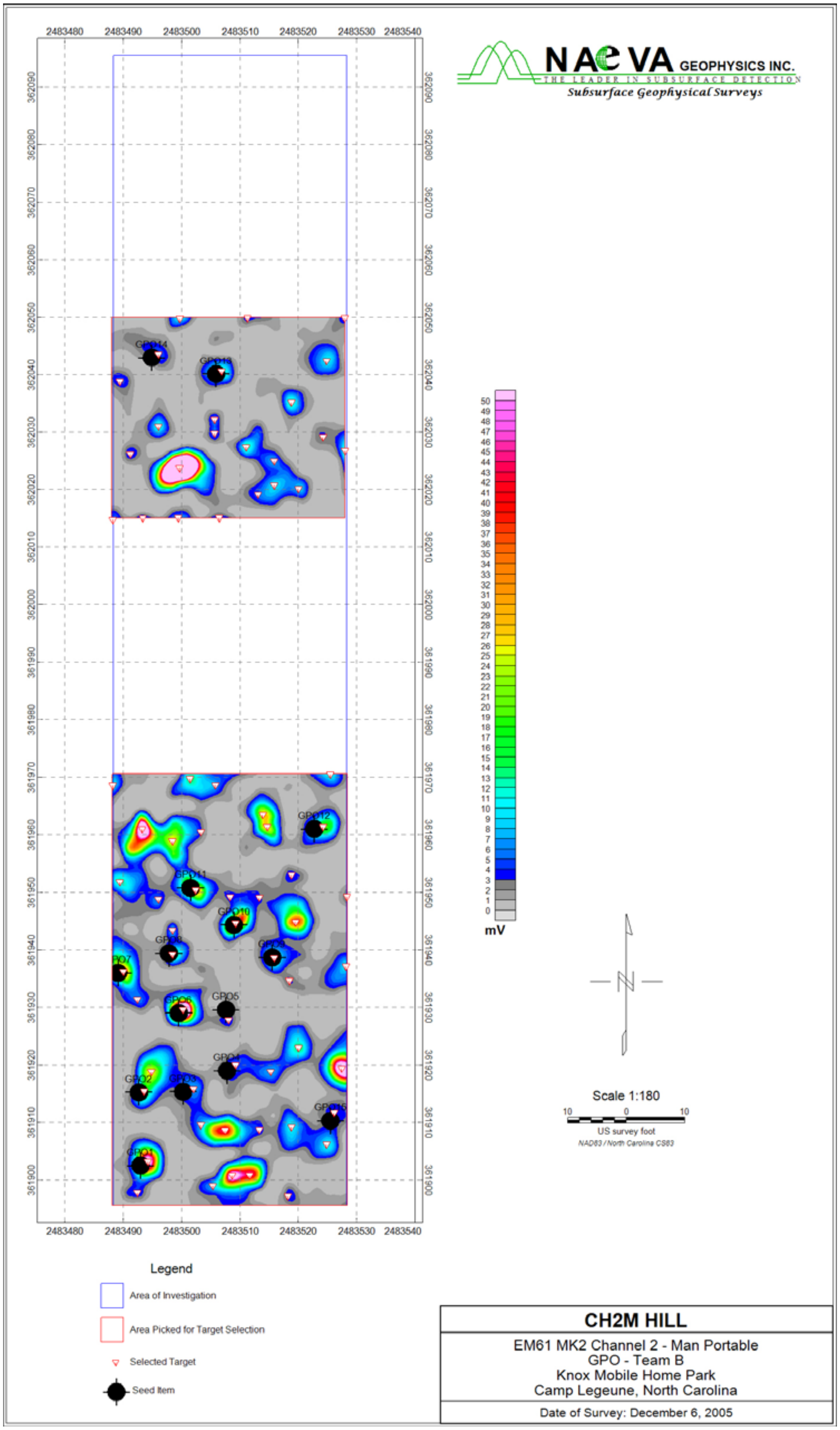


Figure 7. NAEVA Map of EM61-MK2 Single Coil B - Seeded GPO Plot (Location of Seed Items added to Map by CH2M HILL)



APPENDIX B

Results of Geophysical Investigation

Results of Geophysical Investigation

Knox Mobile Home Park, Camp Lejeune, North Carolina

Draft Submittal – March 28, 2006

Prepared By

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1 EXECUTIVE SUMMARY

NAEVA Geophysics, Inc. was contracted to conduct a geophysical investigation at Knox Mobile Home Park in Camp Lejeune, North Carolina. The purpose of this investigation was to map a 133-acre site, 38 acres of which compose the trailer park itself, with the remaining 95 acres in the surrounding wooded area. The area of investigation may have been used as a hand grenade range at an unknown time. While there are no clear documents supporting the existence of an active firing range in this area, four grenades were uncovered within the trailer park. Due to this, geophysical data were evaluated for targets the size and shape of an MK-II or MK-IIA hand grenade.

Geophysical investigations were conducted in two phases. Phase One utilized a dual sensor EM61 MK2 Towed Array system. Phase Two involved one or two single sensor EM61 MK2 systems in hand-towed wheel mode. Phase One was completed on December 23, 2005, and Phase Two was completed on February 23, 2006.

A total of 90.9 acres were surveyed, including the 38 acres within the trailer park and 53 acres of the surrounding wooded area. This is less than the initially proposed 133 acres due to budgetary constraints. A total of 55,230 anomalies were detected and targeted during this investigation. Target lists and maps were provided to CH2M HILL.

2 INTRODUCTION

NAEVA Geophysics, Inc. was contracted by CH2M HILL to conduct digital geophysical mapping of 133 acres in and around Knox Mobile Home Park at MCB Camp Lejeune, North Carolina. The primary objective of the geophysical mapping was to locate Munitions and Explosives of Concern (MEC). The geophysical mapping was to precede the Public Private Venture (PPV) development of this area. The existing Knox Mobile Home Park consists of approximately 38 acres of relatively level ground with few trees. The remaining 95 acres surrounding the Trailer Park consist of moderate to heavily wooded areas. Site preparation work included brush removal and land surveying of 100-foot by 100-foot grid corners. The geophysical investigation took place in multiple phases from December 8, 2005 to February 23, 2006. The final acreage surveyed (90.9 acres) was less than originally proposed due to budgetary constraints.

3 BACKGROUND

Before development of the trailer park in the early 1950's, the area known as Knox Mobil Home Park was used for a variety of military purposes. Although these purposes include dog training and body armor testing, both of which required some use of explosives, there are no records of Knox Mobil Home Park as an established live fire range. The discovery of four hand grenades (MK-II and MK-IIA1) during bulldozer excavation between 1974 and 1976 indicate that this area may have been included in a historic hand grenade range [called the Knox Trailer Park Grenade Range (Area A)].

4 METHODS

Data collection for the digital geophysical mapping for this project took place in two phases. Phase One involved the use of a towed array system, containing two Geonics EM61 MK2 (1m x 0.5m coil) electromagnetic metal detectors in conjunction with Trimble 5700 Real-Time Kinematic (RTK) Global Positioning System (GPS) equipment. During this phase, data collection was limited to the 33 acres of open terrain within the trailer park. Phase Two of the data collection employed one or two teams, each with a single EM61 MK2 metal detector in hand-towed wheel mode. During this phase, data collection took place in the 58 acres of brush-cleared wooded areas surrounding the trailer park, as well as additional locations within the trailer park that could not be collected with the towed array due to accessibility or limited GPS coverage.

4.1 Geonics EM61 MK2 (Electromagnetics)

The EM61 MK2 is a high-resolution time-domain electromagnetic instrument designed to detect, with high spatial resolution, shallow ferrous and non-ferrous metallic objects. The EM61 MK2 system consists of two air-cored coils, a digital data recorder, batteries and processing electronics. The EM61 MK2's transmitter generates a pulsed primary magnetic field, which then induces eddy currents in nearby metallic objects producing a secondary magnetic field. Each of the two spatially separated receiver coils measures these secondary fields. The EM61 MK2 offers the ability to measure the secondary fields at three distinct time intervals in the bottom coil or four intervals if no top coil measurements are recorded. Earlier time gates provide enhanced detection of smaller metallic objects. Secondary voltages induced in both coils by the secondary magnetic field are measured in millivolts (mV). Target resolution of approximately 0.5 meters is expected with the system. EM61 data were initially stored in a hand-held data logger or field PC. Following the completion of each data file, data were transferred to a laptop computer for preliminary evaluation and editing.

4.1.1 Dual EM61 MK2 Towed Array System

NAEVA employed the towed array system in those sections of Knox Trailer Park that were relatively free of tree cover (approximately 33 acres) during Phase One of data collection. The array consists of two 1m x 0.5m coils encased in a durable poly-plastic sled that rests directly on the ground (Figure 1). Coil heights can be adjusted within the sled, but were maintained at the height of 35 cm above the ground for the duration of the project. The system was towed by an eight-wheeled Argo all-terrain vehicle. A 14-ft tongue attached the coil assembly to the tow vehicle and maintained sufficient separation so that the vehicle did not influence the geophysical data. A single GPS sensor was mounted over the center of the two coils to provide real-time positional tracking capabilities. System electronics were securely mounted in the vehicle's rear compartment while the field computer was located in the driver's compartment to allow continuous monitoring of system function. The Geometrics MagLog software was used to continuously record GPS and EM61 data in addition to recording cultural features.

Figure 1. Data collection with the towed array system.

4.1.2 Trimble 5700 RTK GPS system

A Trimble 5700 RTK GPS system was used for the real-time acquisition of positional data during geophysical data collection with the towed array. A GPS base station, utilizing a Trimble 5700 receiver, was used in conjunction with a rover antenna mounted over the center of the EM61 MK2 coils for data collection. Real-time corrections were broadcast to the roving GPS unit via a radio link using TrimMark 3 radio modems. This system provides positional updates at a rate of 1 Hz, with an accuracy of 3-cm horizontal. During data collection with the towed array system, the positional data were stored along with the EM61 MK2 readings in a single file on a Toughbook field computer for later downloading and editing.

The base station, GPO and grid corner positions supplied to the surveyor were in a North Carolina State Plane coordinate system, NAD83.

4.1.3 Hand-Towed EM61 MK2 Data Collection

Phase Two of data collection for this project involved hand-towed operation of an EM61 MK2. Due to tree cover conditions in approximately 95 acres of the survey area (which limits GPS capabilities as well as towed array maneuverability), the EM61 was operated in wheel mode across this terrain. Coil height for the bottom coil, dictated by the height of the manufacturer-supplied wheels, was 40cm above the ground surface. The EM61 data were recorded with an Allegro data logger and Geonics EM61MK2 acquisition software, set to record data at a rate of 10 Hz. Two teams, each equipped with an EM61 MK2, were used during this phase of data collection whenever feasible. Only one team was in operation between January 19, 2006 and February 10, 2006 in an effort to give the brush clearance team enough time to complete an area before a geophysics team caught up to them.

Figure 2. Hand-towed wheel mode data collection with an EM61 MK2

The 100-foot x 100-foot grid corners that were staked in by the surveyor prior to data collection were used for ground control during hand-towed data collection. Measuring tapes were pulled parallel to the direction of the survey across two grids, while fiducial ropes were pulled perpendicular to the survey. Ropes were marked for a line spacing of 2.5 feet and generally placed 25 feet apart. In this manner, the ropes were used to ensure straight lines of data were recorded and to allow the placement of fiducial markers in the data set. The measuring tapes could be used for marking the position of culture or other obstructions as the two 100 x 100 grids were collected.

5 GEOPHYSICAL PROVE-OUT (GPO)

A 200-foot x 60-foot test plot was established for the GPO which allowed the field teams to demonstrate the effectiveness of all instrumentation, methods, and personnel prior to the initiation of fieldwork. The GPO was surveyed first with no seed items to determine the background response, and then with seed items that were chosen to represent the type of anomalies that would be found in the survey area. Although NAEVA was not provided with the locations of the seeded objects, the results of the seeded GPO show a number of discrete anomalies. Both the hand-towed teams completed GPO surveys on December 6, 2005. The Towed Array System was not used to survey the GPO until December 8, 2005 due to logistical issues. The results of all seeded GPO surveys can be found in Appendix D.

6 QUALITY CONTROL DATA

Quality control (QC) procedures were conducted in order to document the proper operation of equipment and techniques. The QC tests were also used to identify any technical problems with the equipment or personnel prior to initiating production mapping. The QC tests conducted at the sites are described below. Samples of various quality control data are included in Appendix B of this report. All QC test results are included in digital format on the CD found in Appendix E of this report, including descriptions and/or explanations of any test irregularities.

6.1.1 Cable Shake Tests

A cable shake test was performed each day, prior to the start of data collection. The cable shake test was performed by logging background data for approximately thirty seconds, followed by measuring the response to the shaking of the EM61 cable(s) for thirty seconds, and then again measuring the background for thirty seconds. In the case of the towed array, both cables were tested for response by shaking. This test is used to observe and document any noise that may result from faulty cables or connections. The only cable shake test failure came as a result of an apparent power surge in nearby power lines (see appendix B for samples).

6.1.2 Personnel Tests

A personnel test was performed each day with the instrument and personnel, prior to data collection. This test was performed by logging background data for approximately thirty seconds, followed by measuring the response to personnel walking in the vicinity of the coils, and then again measuring the background for thirty seconds. During the hand-towed data collection phase of the project, each team conducted their own personnel test with one member of the team recording data while the other walked in the vicinity of the coil. During the towed array data collection phase of the project, two members of the three-person team walked in the vicinity of the coils during the personnel test. This test is used to observe and document any noise that may result from having personnel work in the vicinity of the coils during data collection. The only personnel test failure came as the result of apparent ambient noise, which occurs on a portion of one line (see Appendix B for examples).

6.1.3 Six Line Test

On the first day of data collection, a "Six Line Test" was conducted in hand-towed mode as well as with the Dual EM61 MK2 Towed Array System. An area west of the GPO grid was found to have relatively quiet background and was selected for the test line. A 40-foot long line was established, oriented roughly north-south. The test was conducted in the following manner: Line 1 was surveyed to the north, with no test object. Line 2 was surveyed to the south (along the same line) with no test object. Lines 3 and 4 are the same as 1 and 2, respectively, with a test item (an eight-inch nail) placed at the mid-point of the line. Line 5 was surveyed to the north at an unusually quick pace, and Line 6 to the south using an unusually slow pace, both with the test object in place. This test helps document sensor response to a standard object, system latency, and positional accuracy. The results from the six line tests can be found in Appendix B.

6.1.4 Static Tests

A static test was performed each day, prior to and following data collection. The static tests were performed by logging background data for approximately one minute, followed by measuring the response to the standard calibration item for one minute, and then again measuring the background for one minute. The calibration item used with the towed array system was a sledgehammer. The calibration item used with the hand-towed systems was a two-inch trailer ball. These tests are used to document the consistency of instrument response and to identify any abnormal instrument drift or noise.

A small number of the static tests failed the criteria set forth in the Work Plan. The most common cause was determined to be ambient noise and/or power surges from nearby power lines (see Appendix B for examples).

6.1.5 Latency Lines

Within the survey area at Knox Mobil Home Park, a line with a known item was established for latency/lag checks. The known item used was an eight-inch nail that was placed in the middle of a fifty-foot test line. The hand-towed latency lines were collected with the coil centered over the known item. The towed array latency lines were collected with the item centered between the two coils. Data were acquired with the instrument over the established line prior to and following data collection each day. The purpose of these tests was to demonstrate the latency/lag present in the data positioning. Most of the latency lines in this project were failed by the Geosoft QA/QC software, although when checked manually it is apparent that they are within the tolerance, and the apparent failure appears to be caused by a defect in the program (see Appendix B for examples).

6.1.6 Repeat Lines

Repeat data were collected with both the hand-towed and the dual EM61 MK2 towed array system. In both types of surveys, approximately 3% of the line footage for the surveyed area was recollected to demonstrate repeatability in the instrument response and positioning. Profiles of the repeat lines were plotted alongside the original lines, providing a direct comparison. Each profile was evaluated and determined to show acceptable repeatability in the instrument's response and data positioning (see Appendix B for examples).

6.1.7 GPS QC Check

Prior to each day of data collection with the towed array, the GPS antenna was positioned over a known point and its location was recorded. The purpose of this test is to demonstrate that the GPS was functioning properly and was consistently providing an accurate positional coordinate for the known point. Results of the GPS QC check, including distribution of all points, can be seen in Appendix C.

7 DATA PROCESSING

The geophysical data were temporarily stored in the instrument logger or field computer and then downloaded into a laptop computer for on-site review and editing. Preliminary contour maps were then created for field review. Once in-field editing was completed, the data were electronically transferred to NAEVA's Virginia office for preprocessing, final processing, analysis/target selection and final map production. Geosoft's Oasis Montaj software package was employed to process and contour the data, and to identify and characterize potential MEC targets.

7.1 Dual EM61 MK2 Towed Array Data Processing

7.1.1 Preprocessing

Raw data files had sensor offsets applied and were converted to ASCII format using Geomar Software's Multi61MK2 program. Data were then imported into Geosoft's Oasis Montaj where the following steps were performed:

- Conversion of geographic coordinates to projected state plane coordinates
- Evaluation of data coverage
- Evaluation of data density
- Application of auto leveling and instrument drift corrections
- Application of default lag correction
- Generation of preliminary contour map(s) from gridded data
- Generation of formatted ASCII file containing preprocessed data
- Generation of Planimetric Map for tracking survey progress

7.1.2 Final Processing

After completion of preprocessing, the data were further evaluated and processed to generate final processed data files. Final processing included the following steps:

- Evaluation and refinement of auto leveling and instrument drift corrections
- Evaluation and refinement of lag correction
- Additional digital filtering and enhancement, as necessary
- Generation of formatted ASCII file containing processed data
- Merging of final processed data into a master database containing all towed array data.
- Generation of final maps for each grid containing contoured, gridded data and target locations.

Final processed data were submitted for each dataset. Targets were selected from the data in the master database and processed data files for individual 100-foot x 100-foot grids were subset from the master database. Final processed data for each grid with target selections and a final map were then submitted.

7.1.3 Analysis and Target Selection

The UX-Detect module within Oasis Montaj identifies peak amplitude responses of the frequency associated with, but not limited to, MEC items. Anomalies may generate multiple target designations depending on individual signature characteristics. Each of the anomalies selected by Geosoft as a target was analyzed by trained geophysicists, and evaluated as to its validity and position. Targets found to be invalid or incorrectly located were removed or adjusted. Additionally, anomalies that were not selected by the UX-Detect module, yet deemed to represent a potential MEC target, were manually selected. Target selection was performed on final processed data for the second time-gate of the bottom coil of the EM61 MK2. Each target list provides a unique Target ID, x and y state plane coordinate locations for each target, the recorded peak response, and any appropriate comments (i.e. Culture or Suspected Utility).

7.2 Hand-Towed EM61 MK2 Data Processing

7.2.1 Preprocessing

Raw data files were edited and converted using Geonics DAT61MK2 software. Data were then imported into Geosoft's Oasis Montaj to perform the following:

- Conversion of local grid coordinates to projected state plane coordinates
- Evaluation of data density
- Application of auto leveling and instrument drift corrections
- Application of default lag correction
- Generation of preliminary contour map(s) from gridded data
- Generation of formatted ASCII file containing preprocessed data
- Generation of Planimetric Map for tracking survey progress

7.2.2 Final Processing

After completion of preprocessing, the data were further evaluated and processed to generate final processed data files. Final processing steps included:

- Evaluation and refinement of auto leveling and instrument drift corrections
- Evaluation and refinement of lag correction
- Additional digital filtering and enhancement, as necessary

- Targeting of data, as described below in Section 7.2.3
- Splitting datasets into individual 100-foot x 100-foot grid files
- Generation of formatted ASCII file containing processed data
- Generation of final maps for each grid showing contoured, gridded data and target locations.

7.2.3 Analysis and Target Selection

The UX-Detect module within Oasis Montaj identifies peak amplitude responses of the frequency associated with, but not limited to, MEC items. Anomalies may generate multiple target designations depending on individual signature characteristics. Initial target selections were made based on the gridded data. Data profiles corresponding to the anomalies selected by Geosoft are then analyzed by trained geophysicists, with the targets evaluated as to their validity and position. Targets found to be invalid or incorrectly located were removed or adjusted. Additionally, anomalies that were not selected by the UX-Detect module, yet deemed to represent a potential MEC target, were manually selected. Target selection was performed on final processed data for the second time-gate of the bottom coil of the EM61 MK2. Each target list provides a unique Target ID, x and y state plane coordinate location for each target, the recorded peak response, and any appropriate comments (i.e. Culture or Suspected Utility).

7.3 Quality Control Data Processing

The quality control tests conducted throughout the project were evaluated using Geosoft's QA/QC software. Standard tolerance parameters were input and the data were tested to ensure that tolerance levels were not exceeded.

7.3.1 Cable Shake Tests

An acceptance criterion of +/- 2mV was used with the static calibration test software to evaluate the cable shake test data. Plots were generated showing the profiles associated with the static/background measurements and cable shake measurements. Any readings that fell outside the specified tolerance were flagged on the profile plots and documented in the QC Failure Explanations document.

7.3.2 Personnel Tests

An acceptance criterion of +/- 2mV was used with the static calibration test software to evaluate the personnel test data. Plots were generated showing the profiles associated with the static/background measurements and measurements taken as the personnel moved around the instrument. Any readings that fell outside the specified tolerance were flagged on the profile plots and documented in the QC Failure Explanations document.

7.3.3 Six Line Test

The six line test function in Oasis Montaj was used to measure and evaluate latency effects of the dual towed array and single hand-towed systems. The corrected data profiles are plotted on a map and the peak responses over the test item are evaluated for repeatability of response amplitude, positional accuracy and latency.

7.3.4 Static Tests

An acceptance criterion of +/- 2mV was used with the static calibration test software to evaluate the static test data. Plots were generated showing the profiles associated with the background measurements and measurements with the calibration object in place. Any readings that fell outside the specified tolerances were flagged on the profile plots and documented in the QC Failure Explanations document.

7.3.5 Latency Lines

The Dynamic response test function in Oasis Montaj was used to evaluate the latency line data. This function tests the instrument’s peak response amplitude and positional accuracy over a know seed item and presents the data as stacked profiles wit the seed location displayed for visual inspection. After a lag correction was applied to the data, the positional accuracy was visually inspected for consistency among the tests. The peak amplitude response of the profiles was also evaluated for consistency.

7.3.6 Repeat Lines

Profile plots for repeated lines within each dataset were generated for visual inspection of positional and response repeatability. The plots display the instrument response for the original and resurveyed lines as stacked profiles. The repeatability of the interpolated and offset GPS line path for the towed array system is depicted by displaying a comparison of the positional data below the response profiles.

8 RESULTS

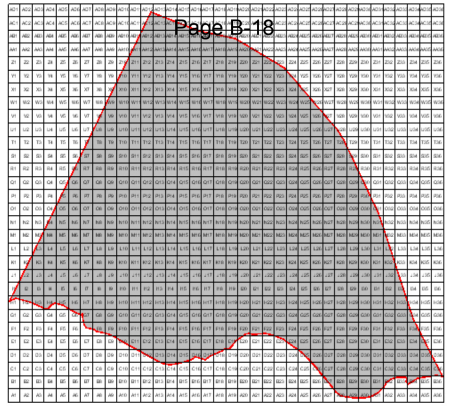
Thirty-three of the 38 acres comprising the Knox Trailer Park were surveyed with the Towed Array System during Phase One of data collection. The remaining five acres were collected in hand-towed wheel mode during Phase Two. An additional 53 acres of data were collected from the north, west, south, and southeast portions of the surrounding wooded area. As the end of the project neared, data collection and brush clearance were focused on the land bordering the river, as well as eight 100-foot by 100-foot sample grids in the woods to the northeast of the trailer park (in which no geophysical data had been previously collected). Phase One was completed on December 23, 2005 and Phase Two was completed on February 23, 2006. A total of 90.9 acres were surveyed, resulting in the detection and targeting of 55,230 anomalies. Example contour maps and target lists can be found in Appendix B.

The contoured mosaic of the field area (Plate 1) and data CD accompanying this report show the success of the geophysical investigation in identifying the anomalous areas as well as numerous linear features of elevated response. The grid-like linear anomalies with responses that exceed 50 mV appear to be utilities which often run parallel to nearby roads. In addition to the linear features, there are two areas of elevated anomalous response that are apparently highly contaminated with metal. These areas include the current Knox Trailer Park and the historic trailer park on the west side of Camp Knox Road. It should be noted that these two large areas of extremely high response are so contaminated with metal that the resulting data may not be reliable for the targeting of MK-II and MK-IIA grenades.

The concentration of targeted anomalies is significantly reduced in the southwest and southeast sections of the area of investigation. The test grids to the northeast of the trailer park indicate that there may be fewer anomalies in this area as well. The data from the southwest corner of the sit contains an increased number of targets which may be related to increased surface clutter or ambient noise.

Elevated geophysical responses are apparent in sections of the south end of the survey area, adjacent to the river. Field observations along portions of the river bank revealed the apparent disposal of a wide range of materials including reinforced concrete, tires with rims, and many other forms of metallic and non-metallic debris. It is assumed that much of this debris was emplaced in an effort to stabilize the riverbank. Current soil and brush cover makes it difficult to define the horizontal extent of this material.

NAEVA GEOPHYSICS INC.
THE LEADER IN SUBSURFACE DETECTION
Subsurface Geophysical Surveys



Legend

Area of Investigation

50 49 48 47 46 45 44 43 42 41 40 39 38 37 36 35 34 33 32 31 30 29 28 27 26 25 24 23 22 21 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0

mV

Scale 1:2400

100 0 100 200 300 400 500 600

US survey foot

NAD83 / North Carolina CS83

Plate 1

Client: CH2M HILL

EM61 MK2 Bottom Coil - Channel 2 - Mosaic
Knox Mobile Home Park
Camp Lejeune, North Carolina

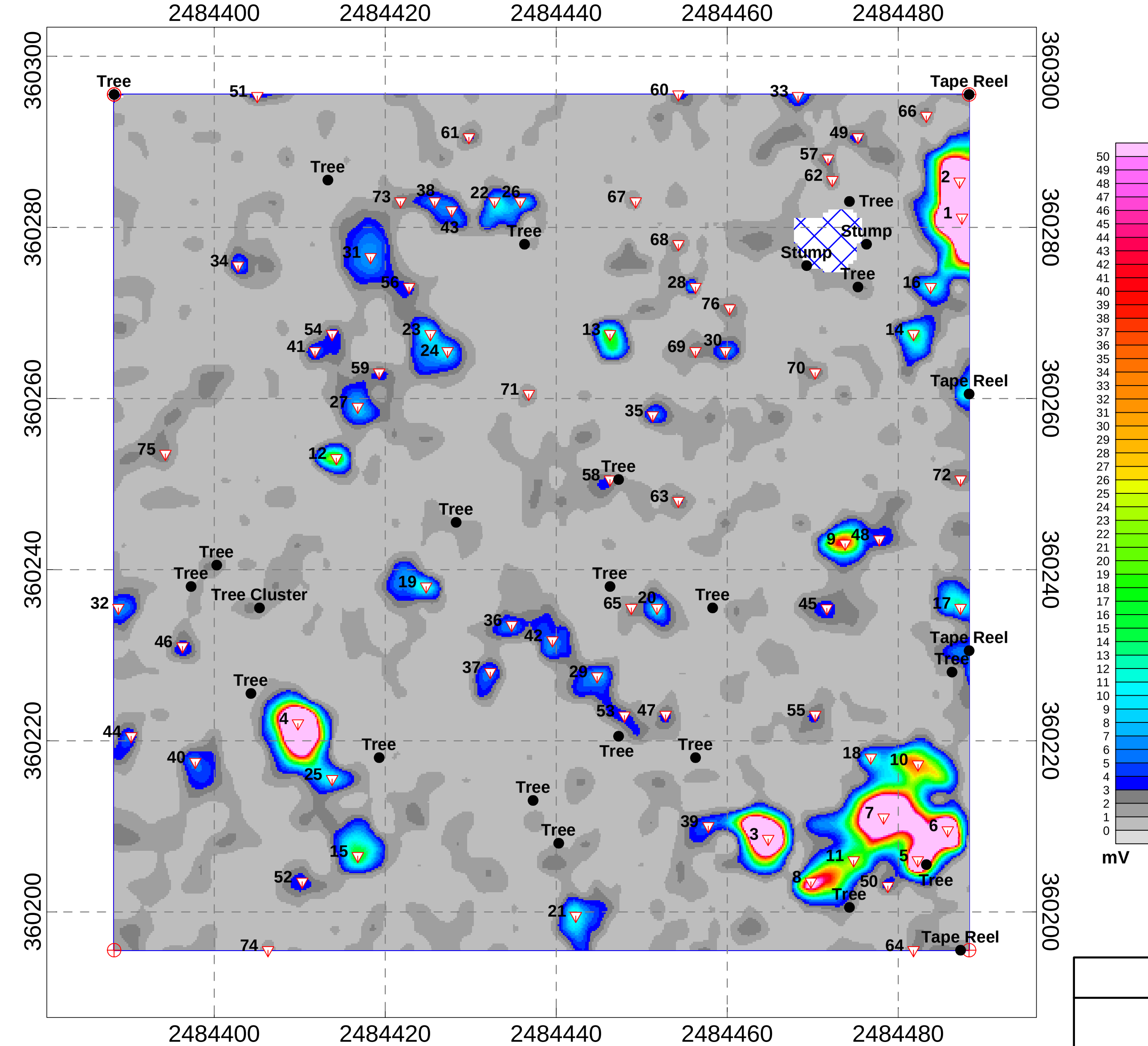
Date of Surveys: December 9, 2005 to February 23, 2006
Date of Map Creation: March 14, 2006

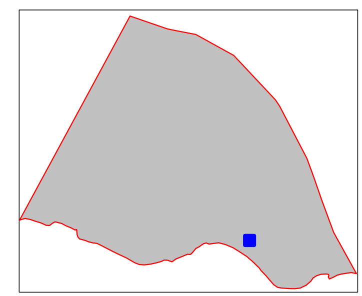
APPENDIX A

Example Color Contour Maps and Target Lists

Grid F25 Contour Map and Target List

NAEVA GEOPHYSICS INC.
THE LEADER IN SUBSURFACE DETECTION
Subsurface Geophysical Surveys





Legend

Area of Investigation

2 Selected Target
(See Target Pick List For Response and Location)

Pole Culture Feature
(Unmarked gaps due to trees)

Grid Corner

Scale 1:240

10 0 10 20

US survey foot

NAD83 / North Carolina CS83

Map File Name: Grid F25.map

Client: CH2M HILL

EM61 MK2 Bottom Coil - Channel 2
Grid F25
Knox Mobile Home Park
Camp Lejeune, North Carolina

Date of Survey: February 21, 2006
Date of Map Creation: February 27, 2006

Map Approver: K. Lemley

CH2M Hill

Grid F25

Knox Mobile Home Park

Camp Lejeune, North Carolina

Target Pick Table (EM-61 MK2- Channel 2)

Target_ID	X_SP	Y_SP	Grid_value	Mask	Comments	Responsible	Grid_ID	Unique_ID
1	2484487.448	360281.1435	2522.72654	1		J. Purnhagen	F25	F25_1
2	2484487.167	360285.3533	1058.07077	1		J. Purnhagen	F25	F25_2
3	2484464.784	360208.535	213.910172	1		J. Purnhagen	F25	F25_3
4	2484409.784	360222.035	209.598999	1		J. Purnhagen	F25	F25_4
5	2484482.284	360206.035	192.278519	1		J. Purnhagen	F25	F25_5
6	2484485.784	360209.535	150.117127	1		J. Purnhagen	F25	F25_6
7	2484478.284	360211.035	141.197647	1		J. Purnhagen	F25	F25_7
8	2484469.784	360203.535	61.1255722	1		J. Purnhagen	F25	F25_8
9	2484473.784	360243.035	46.1021004	1		J. Purnhagen	F25	F25_9
10	2484482.302	360217.2471	33.1708432	1		J. Purnhagen	F25	F25_10
11	2484474.784	360206.035	25.6015739	1		J. Purnhagen	F25	F25_11
12	2484414.284	360253.035	24.8367901	1		J. Purnhagen	F25	F25_12

Target_ID	X_SP	Y_SP	Grid_value	Mask	Comments	Responsible	Grid_ID	Unique_ID
13	2484446.284	360267.535	22.2161465	1		J. Purnhagen	F25	F25_13
14	2484481.784	360267.535	16.5071602	1		J. Purnhagen	F25	F25_14
15	2484416.784	360206.535	15.6908865	1		J. Purnhagen	F25	F25_15
16	2484483.784	360273.035	15.0798225	1		J. Purnhagen	F25	F25_16
17	2484487.284	360235.535	14.6394806	1		J. Purnhagen	F25	F25_17
18	2484476.784	360218.035	14.4342003	1		J. Purnhagen	F25	F25_18
19	2484424.784	360238.035	13.5446711	1		J. Purnhagen	F25	F25_19
20	2484451.784	360235.535	11.3992758	1		J. Purnhagen	F25	F25_20
21	2484442.284	360199.535	11.3783121	1		J. Purnhagen	F25	F25_21
22	2484432.784	360283.035	11.2731886	1		J. Purnhagen	F25	F25_22
23	2484425.284	360267.535	11.2713165	1		J. Purnhagen	F25	F25_23
24	2484427.284	360265.535	11.0135899	1		J. Purnhagen	F25	F25_24
25	2484413.784	360215.535	11.0027151	1		J. Purnhagen	F25	F25_25
26	2484435.784	360283.035	9.41589451	1		J. Purnhagen	F25	F25_26
27	2484416.784	360259.035	8.47061920	1		J. Purnhagen	F25	F25_27
28	2484456.284	360273.035	8.15015984	1		J. Purnhagen	F25	F25_28
29	2484444.784	360227.535	8.06724358	1		J. Purnhagen	F25	F25_29

Target_ID	X_SP	Y_SP	Grid_value	Mask	Comments	Responsible	Grid_ID	Unique_ID
30	2484459.784	360265.535	7.37489796	1		J. Purnhagen	F25	F25_30
31	2484418.284	360276.535	6.85841417	1		J. Purnhagen	F25	F25_31
32	2484388.784	360235.535	6.62089157	1		J. Purnhagen	F25	F25_32
33	2484468.269	360295.3634	6.59996882	1		J. Purnhagen	F25	F25_33
34	2484402.784	360275.535	6.4744463	1		J. Purnhagen	F25	F25_34
35	2484451.284	360258.035	6.40190935	1		J. Purnhagen	F25	F25_35
36	2484434.784	360233.535	6.39195013	1		J. Purnhagen	F25	F25_36
37	2484432.284	360228.035	6.05876303	1		J. Purnhagen	F25	F25_37
38	2484425.784	360283.035	6.01387024	1		J. Purnhagen	F25	F25_38
39	2484457.784	360210.035	5.975667	1		J. Purnhagen	F25	F25_39
40	2484397.784	360217.535	5.97348166	1		J. Purnhagen	F25	F25_40
41	2484411.784	360265.535	5.91553211	1		J. Purnhagen	F25	F25_41
42	2484439.549	360231.7477	5.81381893	1		J. Purnhagen	F25	F25_42
43	2484427.761	360281.9854	5.63513756	1		J. Purnhagen	F25	F25_43
44	2484390.284	360220.535	5.48514986	1		J. Purnhagen	F25	F25_44
45	2484471.637	360235.4898	4.70285559	1		J. Purnhagen	F25	F25_45
46	2484396.284	360231.035	4.54061747	1		J. Purnhagen	F25	F25_46

Target_ID	X_SP	Y_SP	Grid_value	Mask	Comments	Responsible	Grid_ID	Unique_ID
47	2484452.784	360223.035	4.28619432	1		J. Purnhagen	F25	F25_47
48	2484477.784	360243.535	4.2347579	1		J. Purnhagen	F25	F25_48
49	2484475.284	360290.535	4.17996311	1		J. Purnhagen	F25	F25_49
50	2484478.784	360203.035	4.11252165	1		J. Purnhagen	F25	F25_50
51	2484405.028	360295.3634	4.08940455	1		J. Purnhagen	F25	F25_51
52	2484410.284	360203.535	4.0045352	1		J. Purnhagen	F25	F25_52
53	2484447.969	360222.9538	3.96595602	1		J. Purnhagen	F25	F25_53
54	2484413.784	360267.535	3.89665103	1		J. Purnhagen	F25	F25_54
55	2484470.284	360223.035	3.85829091	1		J. Purnhagen	F25	F25_55
56	2484422.784	360273.035	3.85311174	1		J. Purnhagen	F25	F25_56
57	2484471.784	360288.035	3.78170729	1		J. Purnhagen	F25	F25_57
58	2484446.284	360250.535	3.70320058	1		J. Purnhagen	F25	F25_58
59	2484419.284	360263.035	3.70027781	1		J. Purnhagen	F25	F25_59
60	2484454.284	360295.535	3.65364718	1		J. Purnhagen	F25	F25_60
61	2484429.784	360290.535	3.62631154	1		J. Purnhagen	F25	F25_61
62	2484472.284	360285.535	3.55075240	1		J. Purnhagen	F25	F25_62
63	2484454.284	360248.035	3.34448528	1		J. Purnhagen	F25	F25_63

Target_ID	X_SP	Y_SP	Grid_value	Mask	Comments	Responsible	Grid_ID	Unique_ID
64	2484481.784	360195.535	3.34202051	1		J. Purnhagen	F25	F25_64
65	2484448.784	360235.535	3.32427669	1		J. Purnhagen	F25	F25_65
66	2484483.284	360293.035	3.29670334	1		J. Purnhagen	F25	F25_66
67	2484449.284	360283.035	3.23725319	1		J. Purnhagen	F25	F25_67
68	2484454.284	360278.035	3.20872736	1		J. Purnhagen	F25	F25_68
69	2484456.284	360265.535	3.19612074	1		J. Purnhagen	F25	F25_69
70	2484470.284	360263.035	3.18363309	1		J. Purnhagen	F25	F25_70
71	2484436.784	360260.535	3.17453909	1		J. Purnhagen	F25	F25_71
72	2484487.284	360250.535	3.13888407	1		J. Purnhagen	F25	F25_72
73	2484421.784	360283.035	3.13602519	1		J. Purnhagen	F25	F25_73
74	2484406.284	360195.535	3.08370471	1		J. Purnhagen	F25	F25_74
75	2484394.284	360253.535	3.08203387	1		J. Purnhagen	F25	F25_75
76	2484460.284	360270.535	3.04646206	1		J. Purnhagen	F25	F25_76

Grid J7 Contour Map and Target List

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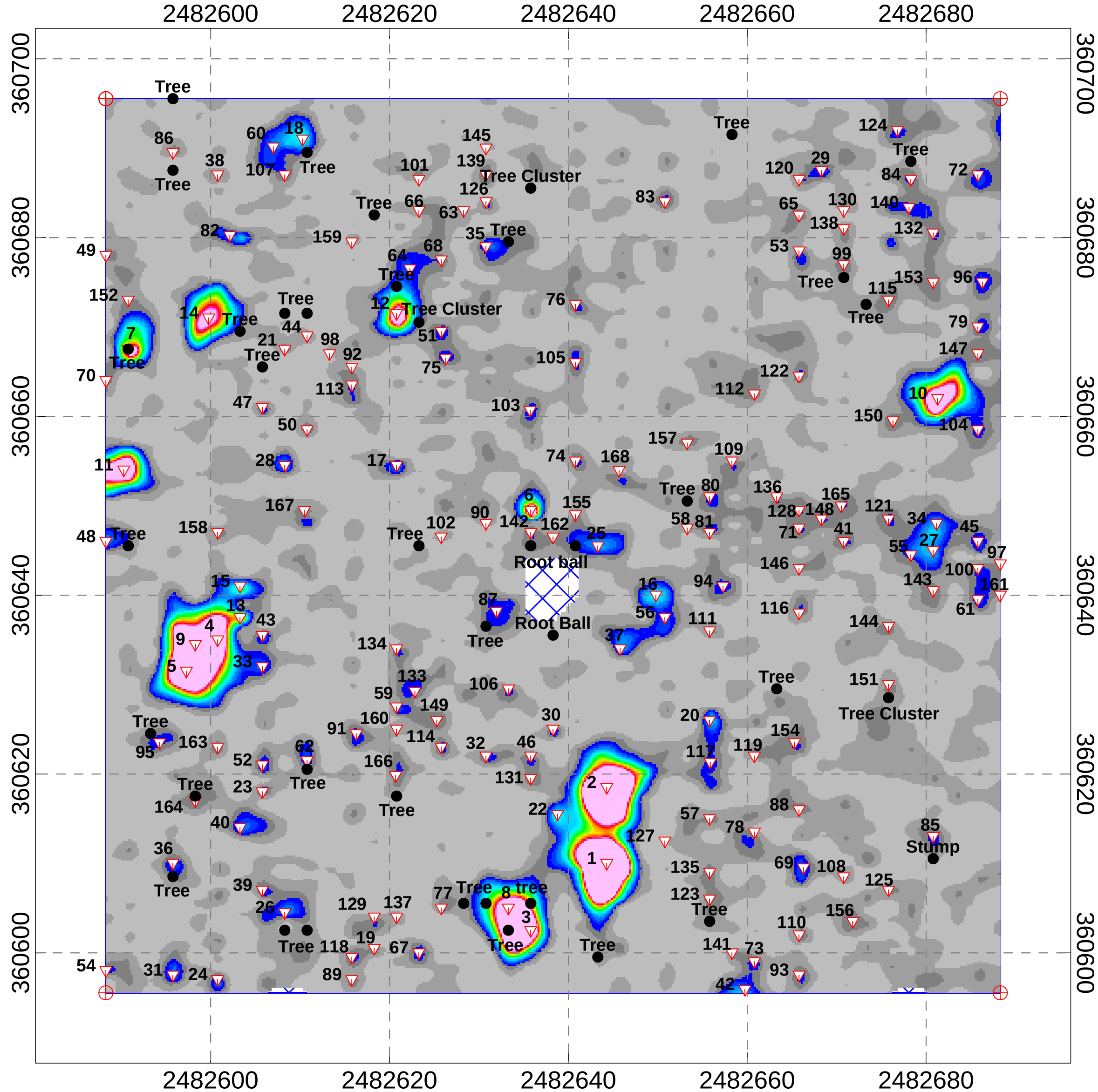
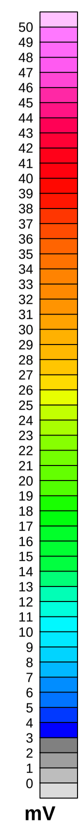
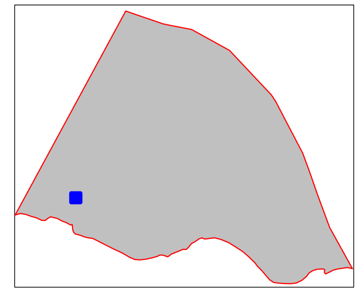
THE LEADER IN SUBSURFACE DETECTION
Subsurface Geophysical Surveys







Legend

Area of Investigation

2 Selected Target
(See Target Pick List For Response and Location)

Pole Culture Feature
(Unmarked gaps due to trees)

Grid Corner

Scale 1:240

10 0 10 20

US survey foot

NAD83 / North Carolina CS83

Client: CH2M HILL

EM61 MK2 Bottom Coil - Channel 2
Grid J7
Knox Mobile Home Park
Camp Lejeune, North Carolina

Date of Survey: January 31, 2006
Date of Map Creation: February 7, 2006

Map Approver: K. Lemley

Map File Name: Grid J7.map

CH2M Hill

Grid J7

Knox Mobile Home Park

Camp Lejeune, North Carolina

Target Pick Table (EM-61 MK2- Channel 2)

Target_ID	X_SP	Y_SP	Grid_value	Mask	Comments	Responsible	Grid_ID	Unique_ID
1	2482644.284	360610.035	1190.65552	1		E. McGlenn	J7	J7_1
2	2482644.284	360618.535	916.616211	1		E. McGlenn	J7	J7_2
3	2482635.784	360602.535	204.42836	1		E. McGlenn	J7	J7_3
4	2482600.784	360635.035	201.965347	1		E. McGlenn	J7	J7_4
5	2482597.284	360631.535	200.387146	1		E. McGlenn	J7	J7_5
6	2482635.784	360649.535	167.667328	1		E. McGlenn	J7	J7_6
7	2482590.784	360667.535	165.340958	1		E. McGlenn	J7	J7_7
8	2482633.284	360605.035	142.722015	1		E. McGlenn	J7	J7_8
9	2482598.284	360634.535	118.863022	1		E. McGlenn	J7	J7_9
10	2482681.284	360662.035	118.13073	1		E. McGlenn	J7	J7_10
11	2482590.284	360654.035	116.304833	1		E. McGlenn	J7	J7_11
12	2482620.784	360671.535	107.464325	1		E. McGlenn	J7	J7_12
13	2482603.284	360637.535	92.3792114	1		E. McGlenn	J7	J7_13
14	2482599.784	360671.035	60.4089088	1		E. McGlenn	J7	J7_14
15	2482603.284	360641.035	20.7506981	1		E. McGlenn	J7	J7_15

Target_ID	X_SP	Y_SP	Grid_value	Mask	Comments	Responsible	Grid_ID	Unique_ID
16	2482649.784	360640.035	11.9029083	1		E. McGlenn	J7	J7_16
17	2482620.784	360654.535	11.7343445	1		E. McGlenn	J7	J7_17
18	2482610.284	360691.035	10.5727377	1		E. McGlenn	J7	J7_18
19	2482618.284	360600.535	10.4547253	1		E. McGlenn	J7	J7_19
20	2482655.784	360626.035	10.3578758	1		E. McGlenn	J7	J7_20
21	2482608.284	360667.535	10.2515383	1		E. McGlenn	J7	J7_21
22	2482638.784	360615.535	10.2509394	1		E. McGlenn	J7	J7_22
23	2482605.784	360618.035	8.63383579	1		E. McGlenn	J7	J7_23
24	2482600.784	360597.035	8.24403095	1		E. McGlenn	J7	J7_24
25	2482643.284	360645.535	7.92900562	1		E. McGlenn	J7	J7_25
26	2482608.284	360604.535	7.90369844	1		E. McGlenn	J7	J7_26
27	2482680.784	360645.035	7.86103535	1		E. McGlenn	J7	J7_27
28	2482608.284	360654.535	7.77943945	1		E. McGlenn	J7	J7_28
29	2482668.284	360687.535	7.77196693	1		E. McGlenn	J7	J7_29
30	2482638.284	360625.035	7.26801062	1		E. McGlenn	J7	J7_30
31	2482595.784	360597.535	7.26373959	1		E. McGlenn	J7	J7_31
32	2482630.784	360622.035	7.17159081	1		E. McGlenn	J7	J7_32
33	2482605.784	360632.035	7.12853479	1		E. McGlenn	J7	J7_33
34	2482681.156	360648.0521	7.05911601	1		E. McGlenn	J7	J7_34
35	2482630.784	360679.035	6.99741793	1		E. McGlenn	J7	J7_35
36	2482595.784	360610.035	6.94928169	1		E. McGlenn	J7	J7_36

Target_ID	X_SP	Y_SP	Grid_value	Mask	Comments	Responsible	Grid_ID	Unique_ID
37	2482645.784	360634.035	6.83834267	1		E. McGlenn	J7	J7_37
38	2482600.784	360687.035	6.7195158	1		E. McGlenn	J7	J7_38
39	2482605.784	360607.035	6.52592754	1		E. McGlenn	J7	J7_39
40	2482603.284	360614.035	6.45929098	1		E. McGlenn	J7	J7_40
41	2482670.784	360646.035	6.40663004	1		E. McGlenn	J7	J7_41
42	2482659.734	360595.9349	6.12699092	1		E. McGlenn	J7	J7_42
43	2482605.784	360635.535	6.01890707	1		E. McGlenn	J7	J7_43
44	2482610.784	360669.035	5.97974491	1		E. McGlenn	J7	J7_44
45	2482685.784	360646.035	5.82864666	1		E. McGlenn	J7	J7_45
46	2482635.784	360622.035	5.81945849	1		E. McGlenn	J7	J7_46
47	2482605.784	360661.035	5.8081193	1		E. McGlenn	J7	J7_47
48	2482588.284	360646.035	5.797328	1		E. McGlenn	J7	J7_48
49	2482588.284	360678.035	5.73535967	1		E. McGlenn	J7	J7_49
50	2482610.784	360658.535	5.70974493	1		E. McGlenn	J7	J7_50
51	2482625.784	360669.535	5.60855293	1		E. McGlenn	J7	J7_51
52	2482605.784	360621.035	5.38081312	1		E. McGlenn	J7	J7_52
53	2482665.784	360678.535	5.32299423	1		E. McGlenn	J7	J7_53
54	2482588.284	360598.035	5.32128954	1		E. McGlenn	J7	J7_54
55	2482678.284	360644.535	5.23118448	1		E. McGlenn	J7	J7_55
56	2482650.784	360637.535	5.21482277	1		E. McGlenn	J7	J7_56
57	2482655.784	360615.035	5.1471386	1		E. McGlenn	J7	J7_57

Target_ID	X_SP	Y_SP	Grid_value	Mask	Comments	Responsible	Grid_ID	Unique_ID
58	2482653.284	360647.535	5.08270788	1		E. McGlenn	J7	J7_58
59	2482620.784	360627.535	5.07434607	1		E. McGlenn	J7	J7_59
60	2482607.002	360690.1604	5.05466036	1		E. McGlenn	J7	J7_60
61	2482685.784	360639.535	5.04945374	1		E. McGlenn	J7	J7_61
62	2482610.784	360621.535	5.03974485	1		E. McGlenn	J7	J7_62
63	2482628.284	360683.035	4.99547863	1		E. McGlenn	J7	J7_63
64	2482622.284	360676.535	4.92144775	1		E. McGlenn	J7	J7_64
65	2482665.784	360682.535	4.83293057	1		E. McGlenn	J7	J7_65
66	2482623.284	360683.035	4.78861904	1		E. McGlenn	J7	J7_66
67	2482623.284	360600.035	4.75740051	1		E. McGlenn	J7	J7_67
68	2482625.784	360677.535	4.72183466	1		E. McGlenn	J7	J7_68
69	2482666.284	360609.535	4.59281158	1		E. McGlenn	J7	J7_69
70	2482588.284	360664.035	4.47396135	1		E. McGlenn	J7	J7_70
71	2482665.784	360647.535	4.47385931	1		E. McGlenn	J7	J7_71
72	2482685.784	360687.035	4.45508909	1		E. McGlenn	J7	J7_72
73	2482660.784	360599.035	4.44980145	1		E. McGlenn	J7	J7_73
74	2482640.784	360655.035	4.44930744	1		E. McGlenn	J7	J7_74
75	2482626.284	360666.535	4.40990400	1		E. McGlenn	J7	J7_75
76	2482640.784	360672.535	4.38930798	1		E. McGlenn	J7	J7_76
77	2482625.784	360605.035	4.31430721	1		E. McGlenn	J7	J7_77
78	2482660.784	360613.535	4.27830124	1		E. McGlenn	J7	J7_78

Target_ID	X_SP	Y_SP	Grid_value	Mask	Comments	Responsible	Grid_ID	Unique_ID
79	2482685.784	360670.035	4.26828766	1		E. McGlenn	J7	J7_79
80	2482655.784	360651.035	4.23214769	1		E. McGlenn	J7	J7_80
81	2482655.784	360647.035	4.22261095	1		E. McGlenn	J7	J7_81
82	2482602.144	360680.2563	4.12261407	1		E. McGlenn	J7	J7_82
83	2482650.784	360684.035	4.11958647	1		E. McGlenn	J7	J7_83
84	2482678.284	360686.535	4.07754135	1		E. McGlenn	J7	J7_84
85	2482680.784	360613.035	4.06883431	1		E. McGlenn	J7	J7_85
86	2482595.784	360689.535	4.06870937	1		E. McGlenn	J7	J7_86
87	2482631.957	360638.2332	4.0344046	1		E. McGlenn	J7	J7_87
88	2482665.784	360616.035	4.00677967	1		E. McGlenn	J7	J7_88
89	2482615.784	360597.035	3.99853635	1		E. McGlenn	J7	J7_89
90	2482630.784	360648.035	3.96090436	1		E. McGlenn	J7	J7_90
91	2482616.284	360624.535	3.92911387	1		E. McGlenn	J7	J7_91
92	2482615.784	360665.535	3.91395736	1		E. McGlenn	J7	J7_92
93	2482665.784	360597.535	3.91019845	1		E. McGlenn	J7	J7_93
94	2482657.284	360641.035	3.8899231	1		E. McGlenn	J7	J7_94
95	2482594.284	360623.535	3.88873339	1		E. McGlenn	J7	J7_95
96	2482686.284	360675.035	3.88670683	1		E. McGlenn	J7	J7_96
97	2482688.284	360643.535	3.8548584	1		E. McGlenn	J7	J7_97
98	2482613.284	360667.035	3.85001993	1		E. McGlenn	J7	J7_98
99	2482670.784	360677.035	3.84515762	1		E. McGlenn	J7	J7_99

Target_ID	X_SP	Y_SP	Grid_value	Mask	Comments	Responsible	Grid_ID	Unique_ID
100	2482685.784	360643.035	3.79596424	1		E. McGlenn	J7	J7_100
101	2482623.284	360686.535	3.78691363	1		E. McGlenn	J7	J7_101
102	2482625.784	360646.535	3.75598073	1		E. McGlenn	J7	J7_102
103	2482635.727	360660.7093	3.73967456	1		E. McGlenn	J7	J7_103
104	2482685.784	360658.535	3.72765422	1		E. McGlenn	J7	J7_104
105	2482640.784	360666.035	3.71930766	1		E. McGlenn	J7	J7_105
106	2482633.284	360629.535	3.67869520	1		E. McGlenn	J7	J7_106
107	2482608.284	360687.035	3.67060733	1		E. McGlenn	J7	J7_107
108	2482670.784	360608.535	3.65908742	1		E. McGlenn	J7	J7_108
109	2482658.284	360655.035	3.64979219	1		E. McGlenn	J7	J7_109
110	2482665.784	360602.035	3.58819342	1		E. McGlenn	J7	J7_110
111	2482655.784	360636.035	3.57868576	1		E. McGlenn	J7	J7_111
112	2482660.784	360662.535	3.56663299	1		E. McGlenn	J7	J7_112
113	2482615.784	360663.535	3.55580711	1		E. McGlenn	J7	J7_113
114	2482625.784	360623.035	3.54230499	1		E. McGlenn	J7	J7_114
115	2482675.784	360673.035	3.53351235	1		E. McGlenn	J7	J7_115
116	2482665.784	360638.035	3.53307128	1		E. McGlenn	J7	J7_116
117	2482655.864	360621.3422	3.51897322	1		E. McGlenn	J7	J7_117
118	2482615.784	360599.535	3.51451898	1		E. McGlenn	J7	J7_118
119	2482660.784	360622.035	3.48396349	1		E. McGlenn	J7	J7_119
120	2482665.784	360686.535	3.46457744	1		E. McGlenn	J7	J7_120

Target_ID	X_SP	Y_SP	Grid_value	Mask	Comments	Responsible	Grid_ID	Unique_ID
121	2482675.784	360648.535	3.46298957	1		E. McGlenn	J7	J7_121
122	2482665.784	360664.535	3.46006441	1		E. McGlenn	J7	J7_122
123	2482655.784	360606.035	3.45691466	1		E. McGlenn	J7	J7_123
124	2482676.784	360692.035	3.45343304	1		E. McGlenn	J7	J7_124
125	2482675.784	360607.035	3.44835448	1		E. McGlenn	J7	J7_125
126	2482630.784	360684.035	3.42741466	1		E. McGlenn	J7	J7_126
127	2482650.784	360612.535	3.38778186	1		E. McGlenn	J7	J7_127
128	2482665.784	360649.535	3.3858738	1		E. McGlenn	J7	J7_128
129	2482618.284	360604.035	3.3855927	1		E. McGlenn	J7	J7_129
130	2482670.784	360683.035	3.3584044	1		E. McGlenn	J7	J7_130
131	2482635.784	360619.535	3.34945846	1		E. McGlenn	J7	J7_131
132	2482680.784	360680.535	3.33823252	1		E. McGlenn	J7	J7_132
133	2482622.819	360629.289	3.3309858	1		E. McGlenn	J7	J7_133
134	2482620.784	360634.035	3.32434607	1		E. McGlenn	J7	J7_134
135	2482655.784	360609.035	3.32085705	1		E. McGlenn	J7	J7_135
136	2482663.284	360651.035	3.31645775	1		E. McGlenn	J7	J7_136
137	2482620.784	360604.035	3.28828859	1		E. McGlenn	J7	J7_137
138	2482670.784	360681.035	3.28766727	1		E. McGlenn	J7	J7_138
139	2482630.784	360687.035	3.27185059	1		E. McGlenn	J7	J7_139
140	2482678.075	360683.3897	3.27048127	1		E. McGlenn	J7	J7_140
141	2482658.284	360600.035	3.23131704	1		E. McGlenn	J7	J7_141

Target_ID	X_SP	Y_SP	Grid_value	Mask	Comments	Responsible	Grid_ID	Unique_ID
142	2482635.784	360647.035	3.2272923	1		E. McGlenn	J7	J7_142
143	2482680.784	360640.535	3.22384548	1		E. McGlenn	J7	J7_143
144	2482675.784	360636.535	3.22353435	1		E. McGlenn	J7	J7_144
145	2482630.784	360690.035	3.19598746	1		E. McGlenn	J7	J7_145
146	2482665.784	360643.035	3.18958664	1		E. McGlenn	J7	J7_146
147	2482685.784	360667.035	3.17463660	1		E. McGlenn	J7	J7_147
148	2482668.284	360648.535	3.16964865	1		E. McGlenn	J7	J7_148
149	2482625.284	360626.035	3.15435004	1		E. McGlenn	J7	J7_149
150	2482676.284	360659.535	3.15327144	1		E. McGlenn	J7	J7_150
151	2482675.784	360630.035	3.15099549	1		E. McGlenn	J7	J7_151
152	2482590.784	360673.035	3.14920688	1		E. McGlenn	J7	J7_152
153	2482680.784	360675.035	3.13792038	1		E. McGlenn	J7	J7_153
154	2482665.284	360623.535	3.13005352	1		E. McGlenn	J7	J7_154
155	2482640.784	360649.035	3.08378744	1		E. McGlenn	J7	J7_155
156	2482671.784	360603.535	3.0804317	1		E. McGlenn	J7	J7_156
157	2482653.284	360657.035	3.07669377	1		E. McGlenn	J7	J7_157
158	2482600.784	360647.035	3.07184410	1		E. McGlenn	J7	J7_158
159	2482615.784	360679.535	3.07074547	1		E. McGlenn	J7	J7_159
160	2482620.784	360625.035	3.06434584	1		E. McGlenn	J7	J7_160
161	2482688.284	360640.035	3.05735016	1		E. McGlenn	J7	J7_161
162	2482638.284	360646.535	3.04683423	1		E. McGlenn	J7	J7_162

Target_ID	X_SP	Y_SP	Grid_value	Mask	Comments	Responsible	Grid_ID	Unique_ID
163	2482600.784	360623.035	3.03740239	1		E. McGlenn	J7	J7_163
164	2482598.284	360617.035	3.00138640	1		E. McGlenn	J7	J7_164
165	2482670.507	360650.006	2.95533010	1		E. McGlenn	J7	J7_165
166	2482620.68	360619.8586	2.68294790	1		E. McGlenn	J7	J7_166
167	2482610.472	360649.5108	2.34657026	1		E. McGlenn	J7	J7_167
168	2482645.665	360653.9829	1.02172562	1		E. McGlenn	J7	J7_168

Grid Q18 Contour Map and Target List

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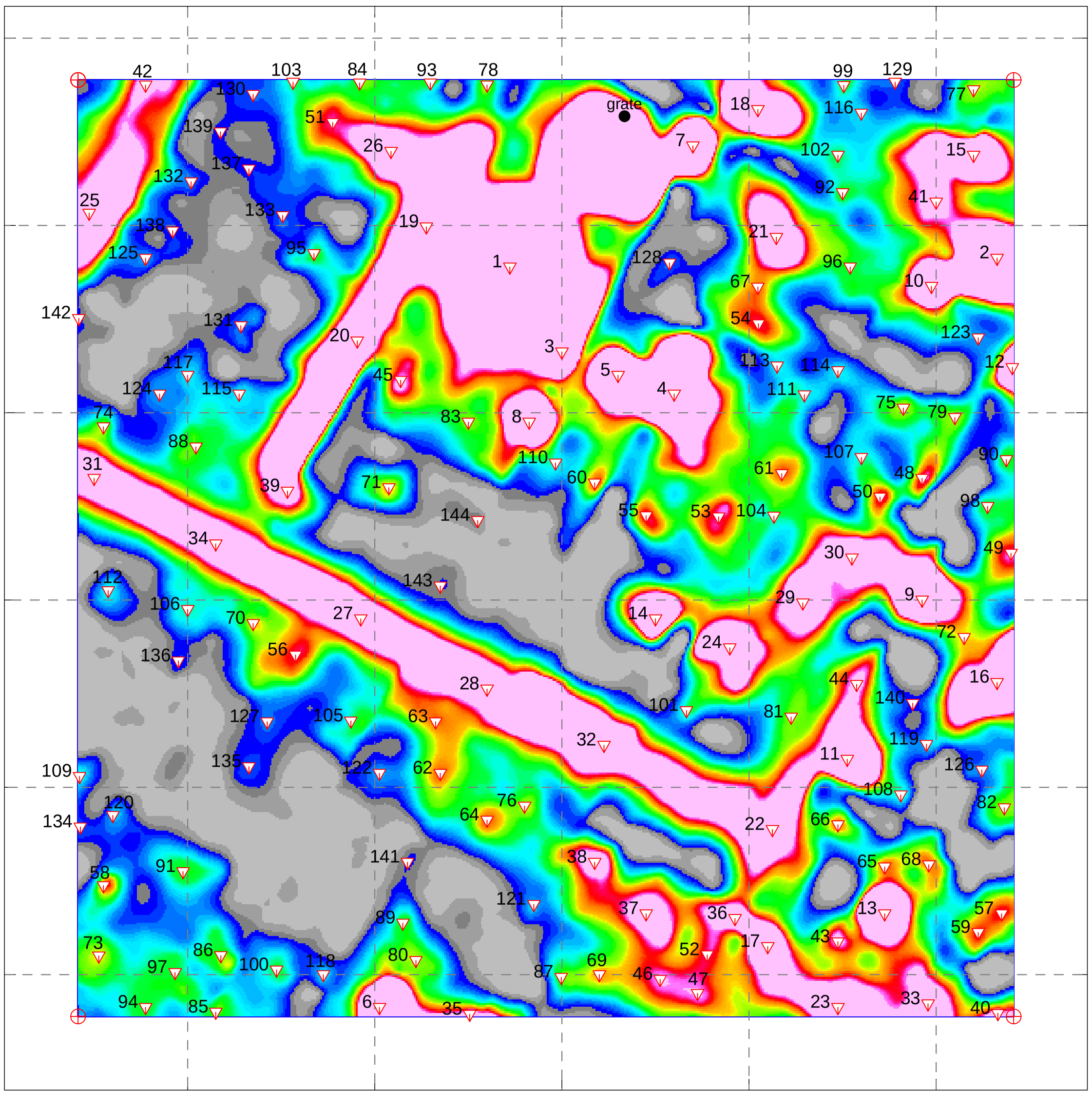
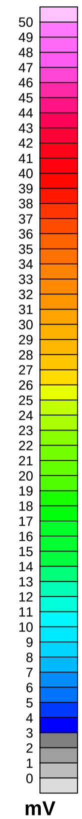
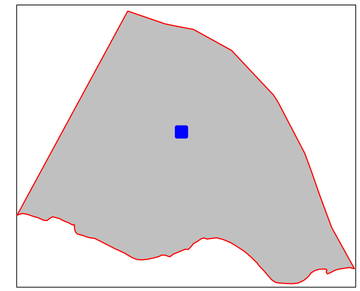
Subsurface Geophysical Surveys







Legend

Area of Investigation

2 Selected Target
(See Target Pick List For Response and Location)

Pole Culture Feature
(Unmarked gaps due to trees)

Grid Corner

Scale 1:240

10 0 10 20

US survey foot

NAD83 / North Carolina CS83

Map File Name: Grid Q18.map

Client: CH2M HILL

EM61 MK2 Bottom Coil - Channel 2
Grid Q18
Knox Mobile Home Park
Camp Lejeune, North Carolina

Date of Survey: December 13 & 15, 2005
Date of Map Creation: February 20, 2006

Map Approver: K. Lemley

CH2M Hill

Grid Q18

Knox Mobile Home Park

Camp Lejeune, North Carolina

Target Pick Table (EM-61 MK2- Channel 2)

Target_ID	X_SP	Y_SP	Grid_value	Mask	Comments	Responsible	Grid_ID	Unique_ID
1	2483734.428	361375.5696	19824.7239	1	Suspected Utility and/or Culture	J. Guillard	Q18	Q18_1
2	2483786.509	361376.5134	1160.55136	1	Suspected Utility and/or Culture	J. Guillard	Q18	Q18_2
3	2483740	361366.5	1078.90051	1	Suspected Utility and/or Culture	J. Guillard	Q18	Q18_3
4	2483752	361362	1059.92053	1	Suspected Utility and/or Culture	J. Guillard	Q18	Q18_4
5	2483746	361364	1028.86511	1	Suspected Utility and/or Culture	J. Guillard	Q18	Q18_5
6	2483720.5	361296.5	974.266968	1	Suspected Utility and/or Culture	J. Guillard	Q18	Q18_6
7	2483754	361388.5	881.67627	1	Suspected Utility and/or Culture	J. Guillard	Q18	Q18_7
8	2483736.5	361359	871.221436	1	Suspected Utility and/or Culture	J. Guillard	Q18	Q18_8
9	2483778.5	361340	611.692810	1	Suspected Utility and/or Culture	J. Guillard	Q18	Q18_9
10	2483779.5	361373.5	500.377106	1	Suspected Utility and/or Culture	J. Guillard	Q18	Q18_10
11	2483770.5	361323	449.315765	1	Suspected Utility and/or Culture	J. Guillard	Q18	Q18_11
12	2483788.139	361364.8445	442.864503	1		J. Guillard	Q18	Q18_12

Target_ID	X_SP	Y_SP	Grid_value	Mask	Comments	Responsible	Grid_ID	Unique_ID
13	2483774.5	361306.5	399.308319	1	Suspected Utility and/or Culture	J. Guillard	Q18	Q18_13
14	2483750	361338	309.895813	1		J. Guillard	Q18	Q18_14
15	2483784	361387.5	291.791168	1	Suspected Utility and/or Culture	J. Guillard	Q18	Q18_15
16	2483786.509	361331.2106	196.739178	1	Suspected Utility and/or Culture	J. Guillard	Q18	Q18_16
17	2483762	361303	190.068924	1	Suspected Utility and/or Culture	J. Guillard	Q18	Q18_17
18	2483760.94	361392.3865	157.677592	1	Suspected Utility and/or Culture	J. Guillard	Q18	Q18_18
19	2483725.504	361379.8596	146.687698	1	Suspected Utility and/or Culture	J. Guillard	Q18	Q18_19
20	2483718.125	361367.6759	136.693091	1	Suspected Utility and/or Culture	J. Guillard	Q18	Q18_20
21	2483762.913	361378.7442	133.789883	1	Suspected Utility and/or Culture	J. Guillard	Q18	Q18_21
22	2483762.5	361315.5	125.110733	1	Suspected Utility and/or Culture	J. Guillard	Q18	Q18_22
23	2483769.5	361296.5	123.107727	1	Suspected Utility and/or Culture	J. Guillard	Q18	Q18_23
24	2483757.937	361334.9001	121.443724	1	Suspected Utility and/or Culture	J. Guillard	Q18	Q18_24
25	2483689.468	361381.3182	117.643195	1	Suspected Utility and/or Culture	J. Guillard	Q18	Q18_25
26	2483721.729	361387.9249	110.763571	1	Suspected Utility and/or Culture	J. Guillard	Q18	Q18_26
27	2483718.5	361338	110.152008	1	Suspected Utility and/or Culture	J. Guillard	Q18	Q18_27
28	2483732	361330.5	108.835144	1	Suspected Utility and/or Culture	J. Guillard	Q18	Q18_28
29	2483765.745	361339.7049	105.075787	1	Suspected Utility and/or Culture	J. Guillard	Q18	Q18_29

Target_ID	X_SP	Y_SP	Grid_value	Mask	Comments	Responsible	Grid_ID	Unique_ID
30	2483771	361344.5	104.831680	1	Suspected Utility and/or Culture	J. Guillard	Q18	Q18_30
31	2483690	361353	102.016090	1	Suspected Utility and/or Culture	J. Guillard	Q18	Q18_31
32	2483744.5	361324.5	99.9075928	1	Suspected Utility and/or Culture	J. Guillard	Q18	Q18_32
33	2483779.13	361296.8904	95.8920513	1	Suspected Utility and/or Culture	J. Guillard	Q18	Q18_33
34	2483703	361346	91.3811646	1	Suspected Utility and/or Culture	J. Guillard	Q18	Q18_34
35	2483730.138	361295.775	81.2878395	1	Suspected Utility and/or Culture	J. Guillard	Q18	Q18_35
36	2483758.5	361306	79.6265183	1	Suspected Utility and/or Culture	J. Guillard	Q18	Q18_36
37	2483749	361306.5	79.1744537	1	Suspected Utility and/or Culture	J. Guillard	Q18	Q18_37
38	2483743.5	361312	78.0574036	1	Suspected Utility and/or Culture	J. Guillard	Q18	Q18_38
39	2483710.661	361351.6312	75.8132558	1	Suspected Utility and/or Culture	J. Guillard	Q18	Q18_39
40	2483786.594	361295.8608	73.394407	1	Suspected Utility and/or Culture	J. Guillard	Q18	Q18_40
41	2483780	361382.5	66.7882919	1	Suspected Utility and/or Culture	J. Guillard	Q18	Q18_41
42	2483695.5	361395	63.457325	1	Suspected Utility and/or Culture	J. Guillard	Q18	Q18_42
43	2483769.5	361303.5	56.9330788	1	Suspected Utility and/or Culture	J. Guillard	Q18	Q18_43
44	2483771.5	361331	56.4269753	1	Suspected Utility and/or Culture	J. Guillard	Q18	Q18_44
45	2483722.759	361363.4717	54.3809356	1		J. Guillard	Q18	Q18_45
46	2483750.5	361299.5	51.7515907	1	Suspected Utility and/or Culture	J. Guillard	Q18	Q18_46

Target_ID	X_SP	Y_SP	Grid_value	Mask	Comments	Responsible	Grid_ID	Unique_ID
47	2483754.5	361298	51.4812317	1	Suspected Utility and/or Culture	J. Guillard	Q18	Q18_47
48	2483778.5	361353	48.660141	1		J. Guillard	Q18	Q18_48
49	2483788	361345	48.3826103	1		J. Guillard	Q18	Q18_49
50	2483774	361351	46.8985710	1		J. Guillard	Q18	Q18_50
51	2483715.5	361391	45.8820992	1	Suspected Utility and/or Culture	J. Guillard	Q18	Q18_51
52	2483755.535	361302.1242	44.3688558	1	Suspected Utility and/or Culture	J. Guillard	Q18	Q18_52
53	2483756.736	361348.8856	44.1560051	1		J. Guillard	Q18	Q18_53
54	2483761	361369.5	43.6800613	1		J. Guillard	Q18	Q18_54
55	2483749	361349	43.3629837	1		J. Guillard	Q18	Q18_55
56	2483711.519	361334.1279	43.2561309	1		J. Guillard	Q18	Q18_56
57	2483787	361306.5	41.8754234	1		J. Guillard	Q18	Q18_57
58	2483691	361309.5	40.6113968	1		J. Guillard	Q18	Q18_58
59	2483784.5	361304.5	40.0272026	1		J. Guillard	Q18	Q18_59
60	2483743.5	361352.5	39.5460739	1		J. Guillard	Q18	Q18_60
61	2483763.5	361353.5	38.014843	1		J. Guillard	Q18	Q18_61
62	2483727	361321.5	37.0983963	1		J. Guillard	Q18	Q18_62
63	2483726.5	361327	36.8666115	1		J. Guillard	Q18	Q18_63
64	2483732	361316.5	36.6416779	1		J. Guillard	Q18	Q18_64
65	2483774.5	361311.5	36.6083984	1		J. Guillard	Q18	Q18_65
66	2483769.5	361316	35.3454781	1		J. Guillard	Q18	Q18_66

Target_ID	X_SP	Y_SP	Grid_value	Mask	Comments	Responsible	Grid_ID	Unique_ID
67	2483760.94	361373.4245	33.9858582	1		J. Guillard	Q18	Q18_67
68	2483779.216	361311.7339	33.5695106	1		J. Guillard	Q18	Q18_68
69	2483744	361300	31.0462933	1		J. Guillard	Q18	Q18_69
70	2483707	361337.5	28.2589340	1		J. Guillard	Q18	Q18_70
71	2483721.5	361352	28.2141666	1		J. Guillard	Q18	Q18_71
72	2483782.991	361336.0155	27.1772588	1		J. Guillard	Q18	Q18_72
73	2483690.5	361302	26.2969532	1		J. Guillard	Q18	Q18_73
74	2483691	361358.5	24.7129612	1		J. Guillard	Q18	Q18_74
75	2483776.5	361360.5	24.3895321	1		J. Guillard	Q18	Q18_75
76	2483736	361318	24.1214352	1		J. Guillard	Q18	Q18_76
77	2483784	361394.5	23.5897045	1		J. Guillard	Q18	Q18_77
78	2483732	361395	22.9917126	1		J. Guillard	Q18	Q18_78
79	2483782	361359.5	22.7978973	1		J. Guillard	Q18	Q18_79
80	2483724.389	361301.5236	22.4980178	1		J. Guillard	Q18	Q18_80
81	2483764.5	361327.5	22.1015720	1	Suspected Utility and/or Culture	J. Guillard	Q18	Q18_81
82	2483787.281	361317.8257	22.0978531	1		J. Guillard	Q18	Q18_82
83	2483730	361359	22.0427914	1		J. Guillard	Q18	Q18_83
84	2483718.383	361395.2179	20.9909662	1		J. Guillard	Q18	Q18_84
85	2483703	361296	20.6782188	1		J. Guillard	Q18	Q18_85
86	2483703.539	361302.0384	20.4617763	1		J. Guillard	Q18	Q18_86
87	2483739.919	361299.7218	19.776261	1		J. Guillard	Q18	Q18_87

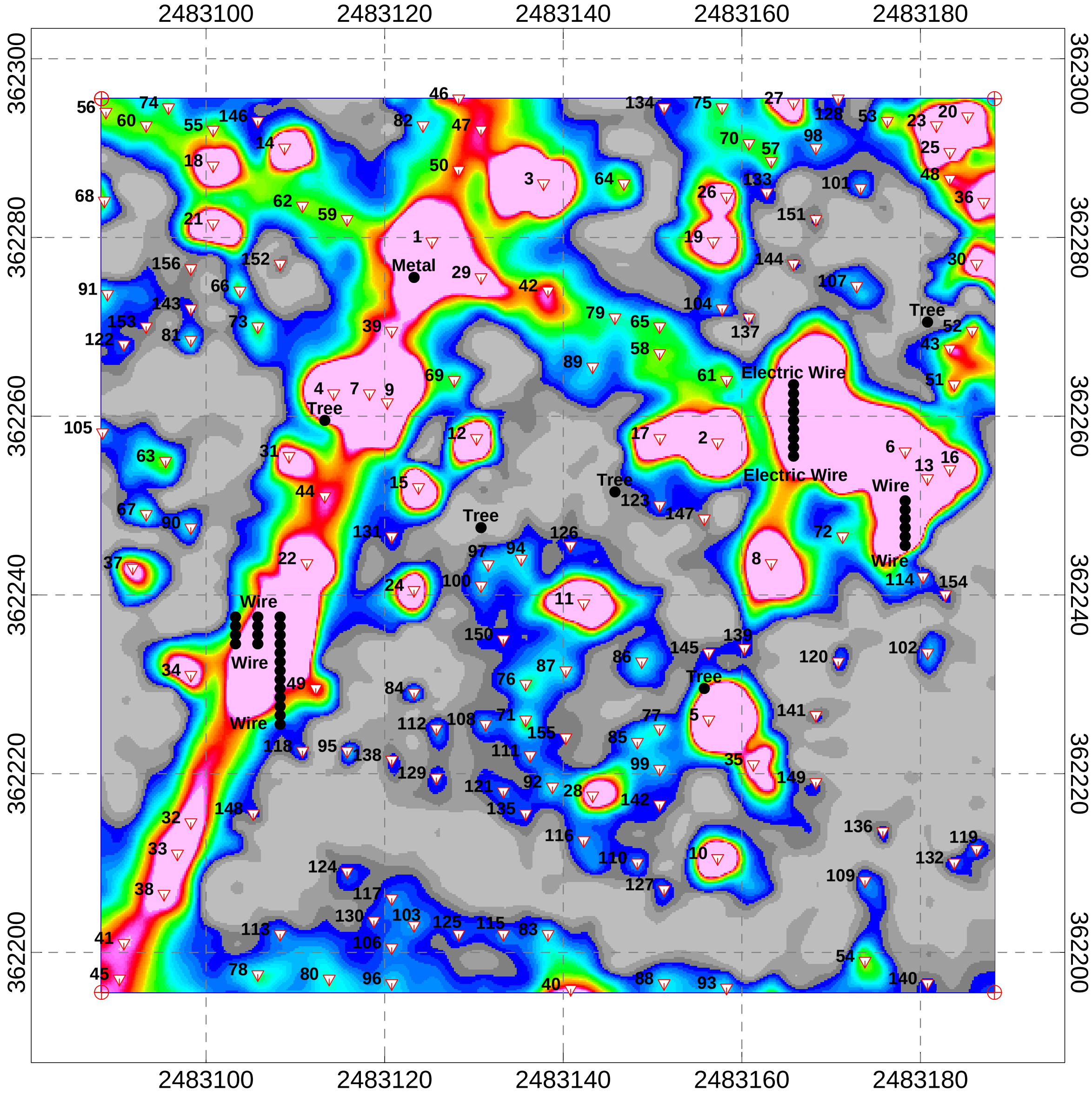
Target_ID	X_SP	Y_SP	Grid_value	Mask	Comments	Responsible	Grid_ID	Unique_ID
88	2483700.88	361356.3502	18.6427987	1		J. Guillard	Q18	Q18_88
89	2483723	361305.5	18.4853363	1		J. Guillard	Q18	Q18_89
90	2483787.5	361355	18.4394531	1		J. Guillard	Q18	Q18_90
91	2483699.5	361311	18.0854073	1		J. Guillard	Q18	Q18_91
92	2483770	361383.5	17.5871658	1		J. Guillard	Q18	Q18_92
93	2483725.933	361395.2179	17.4357754	1		J. Guillard	Q18	Q18_93
94	2483695.5	361296.5	16.8487434	1		J. Guillard	Q18	Q18_94
95	2483713.5	361377	16.5368195	1		J. Guillard	Q18	Q18_95
96	2483770.807	361375.5696	16.0264609	1		J. Guillard	Q18	Q18_96
97	2483698.649	361300.2366	15.5328275	1		J. Guillard	Q18	Q18_97
98	2483785.5	361350	15.4972515	1		J. Guillard	Q18	Q18_98
99	2483770.121	361394.9605	15.4512101	1		J. Guillard	Q18	Q18_99
100	2483709.5	361300.5	14.9458046	1		J. Guillard	Q18	Q18_100
101	2483753.304	361328.2076	14.6992789	1		J. Guillard	Q18	Q18_101
102	2483769.5	361387.5	14.3915091	1		J. Guillard	Q18	Q18_102
103	2483711.261	361395.3037	14.3175517	1		J. Guillard	Q18	Q18_103
104	2483762.656	361348.9714	13.9578920	1		J. Guillard	Q18	Q18_104
105	2483717.439	361327.0922	13.5978382	1		J. Guillard	Q18	Q18_105
106	2483700	361339	12.4381151	1		J. Guillard	Q18	Q18_106
107	2483772.008	361355.2348	12.0260836	1		J. Guillard	Q18	Q18_107
108	2483776.213	361319.1986	11.9622632	1		J. Guillard	Q18	Q18_108

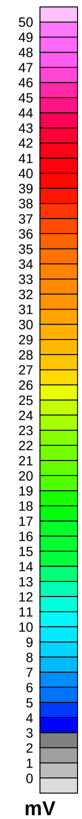
Target_ID	X_SP	Y_SP	Grid_value	Mask	Comments	Responsible	Grid_ID	Unique_ID
109	2483688.438	361321.172	11.4956602	1		J. Guillard	Q18	Q18_109
110	2483739.318	361354.6342	10.8820343	1		J. Guillard	Q18	Q18_110
111	2483765.916	361361.9273	10.8581188	1		J. Guillard	Q18	Q18_111
112	2483691.5	361341	10.349185	1		J. Guillard	Q18	Q18_112
113	2483763	361365	10.3485889	1		J. Guillard	Q18	Q18_113
114	2483769.5	361364.5	10.3177490	1		J. Guillard	Q18	Q18_114
115	2483705.5	361362	10.2021408	1		J. Guillard	Q18	Q18_115
116	2483772	361392	9.54138088	1		J. Guillard	Q18	Q18_116
117	2483700	361364	9.38195992	1		J. Guillard	Q18	Q18_117
118	2483714.5	361300	9.36599922	1		J. Guillard	Q18	Q18_118
119	2483778.958	361324.604	8.45689297	1		J. Guillard	Q18	Q18_119
120	2483692	361317	8.36366367	1		J. Guillard	Q18	Q18_120
121	2483737	361307.5	8.18806744	1		J. Guillard	Q18	Q18_121
122	2483720.5	361321.5	7.59911060	1		J. Guillard	Q18	Q18_122
123	2483784.5	361368	7.09535408	1		J. Guillard	Q18	Q18_123
124	2483697	361362	7.0074935	1		J. Guillard	Q18	Q18_124
125	2483695.5	361376.5	6.85028076	1		J. Guillard	Q18	Q18_125
126	2483784.878	361321.8584	6.16066953	1		J. Guillard	Q18	Q18_126
127	2483708.5	361327	5.73073244	1		J. Guillard	Q18	Q18_127
128	2483751.5	361376	5.36145639	1		J. Guillard	Q18	Q18_128
129	2483775.612	361395.3037	5.35169607	1		J. Guillard	Q18	Q18_129

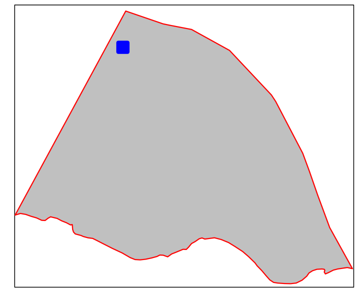
Target_ID	X_SP	Y_SP	Grid_value	Mask	Comments	Responsible	Grid_ID	Unique_ID
130	2483707	361394	5.30156136	1		J. Guillard	Q18	Q18_130
131	2483705.684	361369.3061	5.29134464	1		J. Guillard	Q18	Q18_131
132	2483700.365	361384.6644	5.13860472	1		J. Guillard	Q18	Q18_132
133	2483710.146	361381.0608	4.91260544	1		J. Guillard	Q18	Q18_133
134	2483688.524	361315.7665	4.62484091	1		J. Guillard	Q18	Q18_134
135	2483706.542	361322.2016	4.42424659	1		J. Guillard	Q18	Q18_135
136	2483699	361333.5	4.27618218	1		J. Guillard	Q18	Q18_136
137	2483706.542	361386.0372	4.03634309	1		J. Guillard	Q18	Q18_137
138	2483698.391	361379.4306	4.01058986	1		J. Guillard	Q18	Q18_138
139	2483703.5	361390	3.82123876	1		J. Guillard	Q18	Q18_139
140	2483777.5	361328.9798	3.68588421	1		J. Guillard	Q18	Q18_140
141	2483723.5	361312	3.30909777	1		J. Guillard	Q18	Q18_141
142	2483688.353	361370.0783	3.29938090	1		J. Guillard	Q18	Q18_142
143	2483727	361341.5	3.13632703	1		J. Guillard	Q18	Q18_143
144	2483731	361348.5	3.08158684	1		J. Guillard	Q18	Q18_144

Grid Z12 Contour Map and Target List

NAEVA GEOPHYSICS INC.
THE LEADER IN SUBSURFACE DETECTION
Subsurface Geophysical Surveys







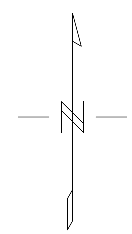
Legend

Area of Investigation

2 Selected Target
(See Target Pick List For Response and Location)

Pole Culture Feature
(Unmarked gaps due to trees)

Grid Corner



Scale 1:240

10 0 10 20

US survey foot

NAD83 / North Carolina CS83

Client: CH2M HILL

EM61 MK2 Bottom Coil - Channel 2
Grid Z12
Knox Mobile Home Park
Camp Lejeune, North Carolina

Date of Survey: January 10, 2006
Date of Map Creation: January 23, 2006

Map Approver: K. Lemley

Map File Name: Grid Z12.map

CH2M Hill

Grid Z12

Knox Mobile Home Park

Camp Lejeune, North Carolina

Target Pick Table (EM-61 MK2- Channel 2)

Target_ID	X_SP	Y_SP	Grid_value	Mask	Comments	Responsible	Grid_ID	Unique_ID
1	2483125.284	362279.535	3923.28931	1	Suspected Culture	J. Mabie	Z12	Z12_1
2	2483157.284	362257.035	2834.89551	1		J. Mabie	Z12	Z12_2
3	2483137.784	362286.035	2464.95776	1		J. Mabie	Z12	Z12_3
4	2483114.284	362262.535	1355.98853	1		J. Mabie	Z12	Z12_4
5	2483156.284	362226.035	1279.13513	1		J. Mabie	Z12	Z12_5
6	2483178.284	362256.035	820.646179	1	Suspected Culture	J. Mabie	Z12	Z12_6
7	2483118.284	362262.535	763.034241	1		J. Mabie	Z12	Z12_7
8	2483163.284	362243.535	629.693909	1		J. Mabie	Z12	Z12_8
9	2483120.284	362261.535	524.392517	1		J. Mabie	Z12	Z12_9
10	2483157.284	362210.535	474.779266	1		J. Mabie	Z12	Z12_10
11	2483142.284	362239.035	379.27417	1		J. Mabie	Z12	Z12_11
12	2483130.284	362257.535	375.141327	1		J. Mabie	Z12	Z12_12
13	2483180.784	362253.035	334.314453	1	Suspected Culture	J. Mabie	Z12	Z12_13
14	2483108.784	362290.035	331.78653	1		J. Mabie	Z12	Z12_14
15	2483123.784	362252.035	330.617065	1		J. Mabie	Z12	Z12_15

Target_ID	X_SP	Y_SP	Grid_value	Mask	Comments	Responsible	Grid_ID	Unique_ID
16	2483183.284	362254.035	319.017456	1	Suspected Culture	J. Mabie	Z12	Z12_16
17	2483150.822	362257.5428	259.921962	1		J. Mabie	Z12	Z12_17
18	2483100.784	362288.035	247.060028	1		J. Mabie	Z12	Z12_18
19	2483156.784	362279.535	245.950211	1		J. Mabie	Z12	Z12_19
20	2483185.284	362293.535	229.805817	1		J. Mabie	Z12	Z12_20
21	2483100.784	362281.535	229.004852	1		J. Mabie	Z12	Z12_21
22	2483111.284	362243.535	227.295578	1	Suspected Culture	J. Mabie	Z12	Z12_22
23	2483181.784	362292.535	211.072846	1		J. Mabie	Z12	Z12_23
24	2483123.284	362240.535	201.796112	1		J. Mabie	Z12	Z12_24
25	2483183.284	362289.535	194.901611	1		J. Mabie	Z12	Z12_25
26	2483158.284	362284.535	165.173477	1		J. Mabie	Z12	Z12_26
27	2483165.784	362295.035	154.805862	1		J. Mabie	Z12	Z12_27
28	2483143.284	362217.535	150.095947	1		J. Mabie	Z12	Z12_28
29	2483130.784	362275.535	139.602264	1	Suspected Culture	J. Mabie	Z12	Z12_29
30	2483186.284	362277.035	118.833664	1		J. Mabie	Z12	Z12_30
31	2483109.284	362255.535	93.6207504	1		J. Mabie	Z12	Z12_31
32	2483098.284	362214.535	91.8641281	1		J. Mabie	Z12	Z12_32
33	2483096.784	362211.035	88.1843262	1		J. Mabie	Z12	Z12_33
34	2483098.284	362231.035	81.3256455	1		J. Mabie	Z12	Z12_34
35	2483161.284	362221.035	73.6877441	1		J. Mabie	Z12	Z12_35
36	2483187.092	362283.9509	67.4701554	1		J. Mabie	Z12	Z12_36

Target_ID	X_SP	Y_SP	Grid_value	Mask	Comments	Responsible	Grid_ID	Unique_ID
37	2483091.784	362243.035	64.4172669	1		J. Mabie	Z12	Z12_37
38	2483095.284	362206.535	61.0344849	1		J. Mabie	Z12	Z12_38
39	2483120.784	362269.535	57.6709061	1		J. Mabie	Z12	Z12_39
40	2483140.831	362195.8915	54.6377905	1		J. Mabie	Z12	Z12_40
41	2483090.784	362201.035	52.6279488	1		J. Mabie	Z12	Z12_41
42	2483138.284	362274.035	50.0944405	1		J. Mabie	Z12	Z12_42
43	2483183.284	362267.535	49.3531952	1		J. Mabie	Z12	Z12_43
44	2483113.284	362251.035	47.6600075	1		J. Mabie	Z12	Z12_44
45	2483090.284	362197.035	47.4637489	1		J. Mabie	Z12	Z12_45
46	2483128.284	362295.535	47.024292	1		J. Mabie	Z12	Z12_46
47	2483130.784	362292.035	46.2722282	1		J. Mabie	Z12	Z12_47
48	2483183.284	362286.535	45.89114	1		J. Mabie	Z12	Z12_48
49	2483112.284	362229.535	43.7048149	1		J. Mabie	Z12	Z12_49
50	2483128.284	362287.535	41.4989395	1		J. Mabie	Z12	Z12_50
51	2483183.784	362263.535	40.1211205	1		J. Mabie	Z12	Z12_51
52	2483185.784	362269.535	39.1238785	1		J. Mabie	Z12	Z12_52
53	2483176.284	362293.035	29.596983	1		J. Mabie	Z12	Z12_53
54	2483173.784	362199.035	25.3781357	1		J. Mabie	Z12	Z12_54
55	2483100.784	362292.035	24.7010117	1		J. Mabie	Z12	Z12_55
56	2483088.784	362294.035	23.9296475	1		J. Mabie	Z12	Z12_56
57	2483163.284	362288.535	23.6228161	1		J. Mabie	Z12	Z12_57

Target_ID	X_SP	Y_SP	Grid_value	Mask	Comments	Responsible	Grid_ID	Unique_ID
58	2483150.784	362267.035	23.4804707	1		J. Mabie	Z12	Z12_58
59	2483115.784	362282.035	23.2906265	1		J. Mabie	Z12	Z12_59
60	2483093.284	362292.535	23.2453194	1		J. Mabie	Z12	Z12_60
61	2483158.284	362264.035	22.8564892	1		J. Mabie	Z12	Z12_61
62	2483110.784	362283.535	22.2157192	1		J. Mabie	Z12	Z12_62
63	2483095.452	362254.9967	20.7896990	1		J. Mabie	Z12	Z12_63
64	2483146.784	362286.035	20.6971283	1		J. Mabie	Z12	Z12_64
65	2483150.784	362270.035	17.6760273	1		J. Mabie	Z12	Z12_65
66	2483103.784	362274.035	17.5513439	1		J. Mabie	Z12	Z12_66
67	2483093.284	362249.035	17.327528	1		J. Mabie	Z12	Z12_67
68	2483088.603	362284.1107	16.7989242	1		J. Mabie	Z12	Z12_68
69	2483127.784	362264.035	16.4404354	1		J. Mabie	Z12	Z12_69
70	2483160.784	362290.535	16.4357739	1		J. Mabie	Z12	Z12_70
71	2483135.784	362226.035	16.296772	1		J. Mabie	Z12	Z12_71
72	2483171.284	362246.535	15.9499044	1		J. Mabie	Z12	Z12_72
73	2483105.784	362270.035	15.847868	1		J. Mabie	Z12	Z12_73
74	2483095.784	362294.535	15.5959129	1		J. Mabie	Z12	Z12_74
75	2483157.784	362294.535	15.1238785	1		J. Mabie	Z12	Z12_75
76	2483135.784	362230.035	14.9106960	1		J. Mabie	Z12	Z12_76
77	2483150.784	362225.035	13.7792959	1		J. Mabie	Z12	Z12_77
78	2483105.784	362197.535	13.6984119	1		J. Mabie	Z12	Z12_78

Target_ID	X_SP	Y_SP	Grid_value	Mask	Comments	Responsible	Grid_ID	Unique_ID
79	2483145.784	362271.035	13.1317606	1		J. Mabie	Z12	Z12_79
80	2483113.784	362197.035	11.8882475	1		J. Mabie	Z12	Z12_80
81	2483098.284	362268.535	11.3807201	1		J. Mabie	Z12	Z12_81
82	2483124.284	362292.535	11.3108730	1		J. Mabie	Z12	Z12_82
83	2483138.284	362202.035	11.1662712	1		J. Mabie	Z12	Z12_83
84	2483123.284	362229.035	10.9023275	1		J. Mabie	Z12	Z12_84
85	2483148.284	362223.535	10.8567772	1		J. Mabie	Z12	Z12_85
86	2483148.784	362232.535	10.6328535	1		J. Mabie	Z12	Z12_86
87	2483140.284	362231.535	10.3355045	1		J. Mabie	Z12	Z12_87
88	2483151.284	362196.535	10.1471834	1		J. Mabie	Z12	Z12_88
89	2483143.284	362265.535	10.0182371	1		J. Mabie	Z12	Z12_89
90	2483098.284	362247.535	9.98025036	1		J. Mabie	Z12	Z12_90
91	2483088.944	362273.6652	9.9275329	1		J. Mabie	Z12	Z12_91
92	2483138.784	362218.535	9.84777355	1		J. Mabie	Z12	Z12_92
93	2483158.284	362196.035	9.61592293	1		J. Mabie	Z12	Z12_93
94	2483135.284	362244.035	9.38174534	1		J. Mabie	Z12	Z12_94
95	2483115.784	362222.535	9.33920384	1		J. Mabie	Z12	Z12_95
96	2483120.784	362196.535	9.28195763	1		J. Mabie	Z12	Z12_96
97	2483131.576	362243.4055	8.85357325	1		J. Mabie	Z12	Z12_97
98	2483168.284	362290.035	8.70954418	1		J. Mabie	Z12	Z12_98
99	2483150.784	362220.535	8.64134789	1		J. Mabie	Z12	Z12_99

Target_ID	X_SP	Y_SP	Grid_value	Mask	Comments	Responsible	Grid_ID	Unique_ID
100	2483130.784	362241.035	8.58754444	1		J. Mabie	Z12	Z12_100
101	2483173.284	362285.535	8.32836056	1		J. Mabie	Z12	Z12_101
102	2483180.784	362233.535	8.06359768	1		J. Mabie	Z12	Z12_102
103	2483123.284	362203.035	8.02123451	1		J. Mabie	Z12	Z12_103
104	2483157.784	362272.035	7.77124596	1		J. Mabie	Z12	Z12_104
105	2483088.399	362258.169	7.75782579	1		J. Mabie	Z12	Z12_105
106	2483120.784	362200.535	7.49966669	1		J. Mabie	Z12	Z12_106
107	2483172.849	362274.5735	7.31265571	1		J. Mabie	Z12	Z12_107
108	2483131.284	362225.535	7.29349566	1		J. Mabie	Z12	Z12_108
109	2483173.784	362208.035	7.00281334	1		J. Mabie	Z12	Z12_109
110	2483148.284	362210.035	6.9985137	1		J. Mabie	Z12	Z12_110
111	2483136.284	362222.035	6.9357481	1		J. Mabie	Z12	Z12_111
112	2483125.784	362225.035	6.78907585	1		J. Mabie	Z12	Z12_112
113	2483108.284	362202.035	6.60853434	1		J. Mabie	Z12	Z12_113
114	2483180.284	362242.035	6.49036551	1		J. Mabie	Z12	Z12_114
115	2483133.284	362202.035	6.46729803	1		J. Mabie	Z12	Z12_115
116	2483142.284	362212.535	6.42697620	1		J. Mabie	Z12	Z12_116
117	2483120.784	362206.035	6.37656975	1		J. Mabie	Z12	Z12_117
118	2483110.784	362222.535	6.24431801	1		J. Mabie	Z12	Z12_118
119	2483186.284	362211.535	6.06743813	1		J. Mabie	Z12	Z12_119
120	2483170.784	362232.535	5.7646246	1		J. Mabie	Z12	Z12_120

Target_ID	X_SP	Y_SP	Grid_value	Mask	Comments	Responsible	Grid_ID	Unique_ID
121	2483133.284	362218.035	5.73929501	1		J. Mabie	Z12	Z12_121
122	2483090.784	362268.035	5.64346647	1		J. Mabie	Z12	Z12_122
123	2483150.784	362250.035	5.60728741	1		J. Mabie	Z12	Z12_123
124	2483115.784	362209.035	5.25865412	1		J. Mabie	Z12	Z12_124
125	2483128.284	362202.035	5.24931955	1		J. Mabie	Z12	Z12_125
126	2483140.784	362245.535	5.13003683	1		J. Mabie	Z12	Z12_126
127	2483151.284	362207.035	5.11131334	1		J. Mabie	Z12	Z12_127
128	2483170.784	362295.535	5.01790476	1		J. Mabie	Z12	Z12_128
129	2483125.784	362219.535	5.00387955	1		J. Mabie	Z12	Z12_129
130	2483118.784	362203.535	4.96274614	1		J. Mabie	Z12	Z12_130
131	2483120.784	362246.535	4.91399336	1		J. Mabie	Z12	Z12_131
132	2483183.784	362210.035	4.73768854	1		J. Mabie	Z12	Z12_132
133	2483162.784	362285.035	4.54036808	1		J. Mabie	Z12	Z12_133
134	2483151.284	362294.535	4.51081133	1		J. Mabie	Z12	Z12_134
135	2483135.784	362215.535	4.4961648	1		J. Mabie	Z12	Z12_135
136	2483175.784	362213.535	4.39569855	1		J. Mabie	Z12	Z12_136
137	2483160.784	362271.035	4.33911800	1		J. Mabie	Z12	Z12_137
138	2483120.784	362221.535	4.27874327	1		J. Mabie	Z12	Z12_138
139	2483160.284	362234.035	4.15404558	1		J. Mabie	Z12	Z12_139
140	2483180.784	362196.535	4.09676981	1		J. Mabie	Z12	Z12_140
141	2483168.284	362226.535	4.01029873	1		J. Mabie	Z12	Z12_141

Target_ID	X_SP	Y_SP	Grid_value	Mask	Comments	Responsible	Grid_ID	Unique_ID
142	2483150.784	362216.535	3.95320725	1		J. Mabie	Z12	Z12_142
143	2483098.284	362272.035	3.87328434	1		J. Mabie	Z12	Z12_143
144	2483165.784	362277.035	3.86967039	1		J. Mabie	Z12	Z12_144
145	2483156.284	362233.535	3.82131219	1		J. Mabie	Z12	Z12_145
146	2483105.784	362293.035	3.72671962	1		J. Mabie	Z12	Z12_146
147	2483155.784	362248.535	3.57527828	1		J. Mabie	Z12	Z12_147
148	2483105.284	362215.535	3.56712318	1		J. Mabie	Z12	Z12_148
149	2483168.284	362219.035	3.54430032	1		J. Mabie	Z12	Z12_149
150	2483133.284	362235.035	3.51957965	1		J. Mabie	Z12	Z12_150
151	2483168.284	362282.035	3.48845625	1		J. Mabie	Z12	Z12_151
152	2483108.284	362277.035	3.34714007	1		J. Mabie	Z12	Z12_152
153	2483093.284	362270.035	3.33162713	1		J. Mabie	Z12	Z12_153
154	2483182.784	362240.035	3.3191011	1		J. Mabie	Z12	Z12_154
155	2483140.284	362224.035	3.07925034	1		J. Mabie	Z12	Z12_155
156	2483098.284	362276.535	3.07339072	1		J. Mabie	Z12	Z12_156

APPENDIX B

Example EM61 Data QC Tests

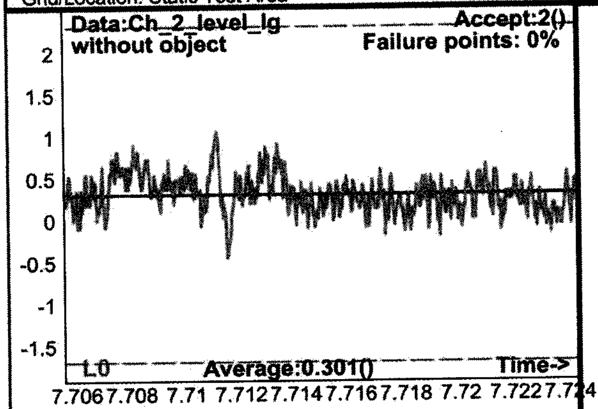
Static Test Profiles – Hand Towed

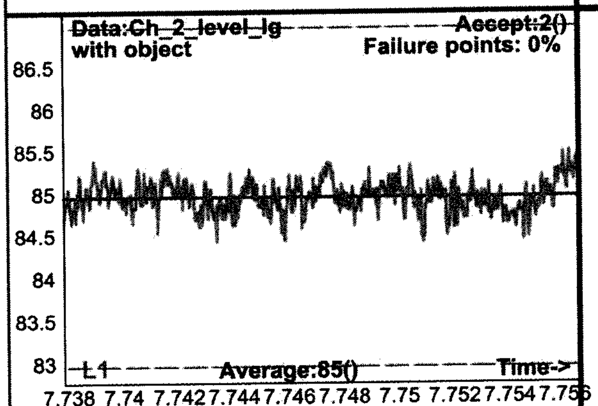
Static Calibration Test

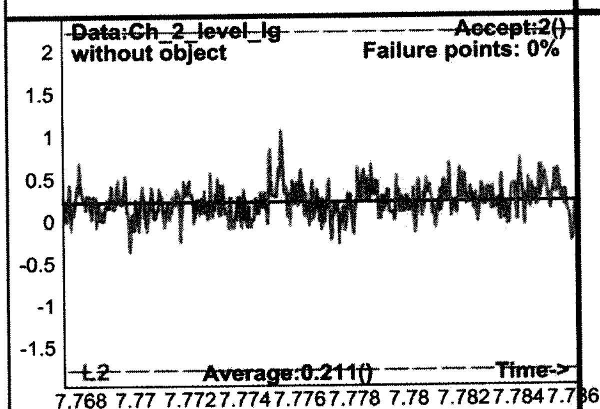
Project: Knox Mobile Home Park
Equipment: EM-61 Mark II
Grid/Location: Static Test Area

Instrument Threshold: 20%
Outside range
Acceptable limits

AM test
Operator: Team B
Date: 2006/02/20







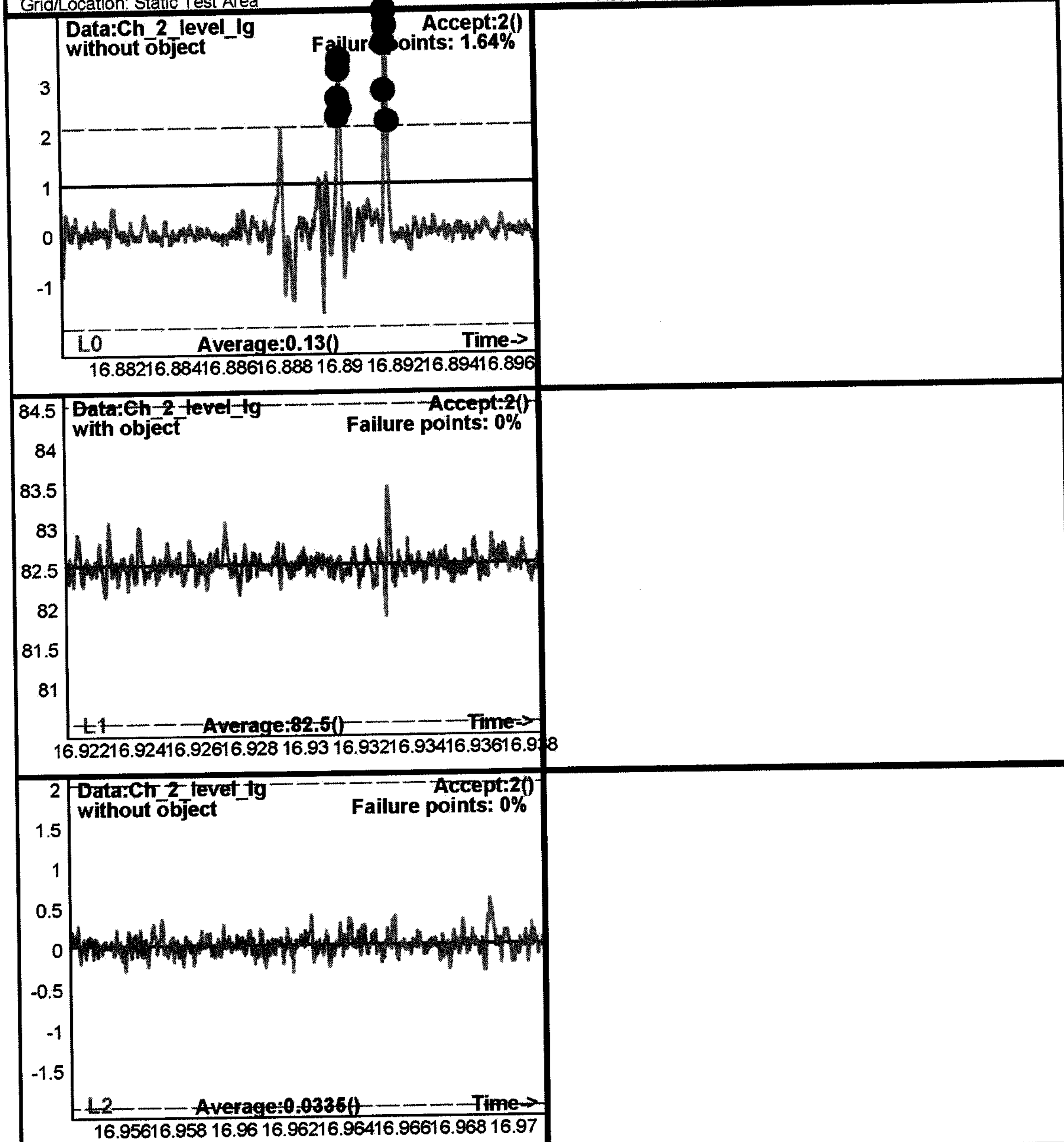
Database: Q:\Virginia Office\CH2M HILL\Camp Lejeune\Knox Mobile Home Park\Geosoft\QC Data\Single QC Data\220AMQCB.g
Line Name: L0 L1 L2
Page: 2

Static Calibration Test

Project: Knox Mobile Home Park
Equipment: EM-61 Mark II
Grid/Location: Static Test Area

Instrument Threshold: 20%
Outside range
Acceptable limits

PM test
Operator: Team B
Date: 2006/01/11



Database: g:\virginia office\ch2m hill\camp lejeune\knox mobile home park\geosoft\qc data\single qc data\111PMQCB.gdb
Line Name: L0 L1 L2

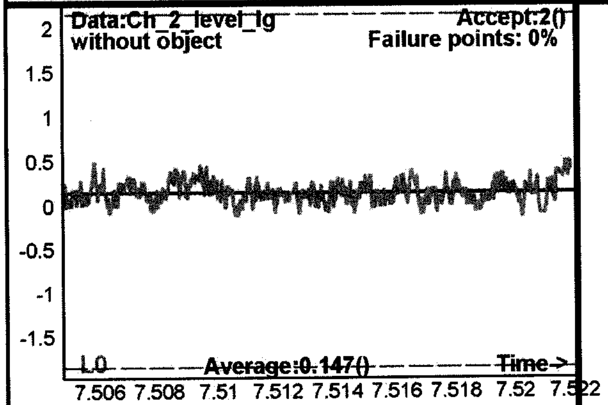
Page: 2

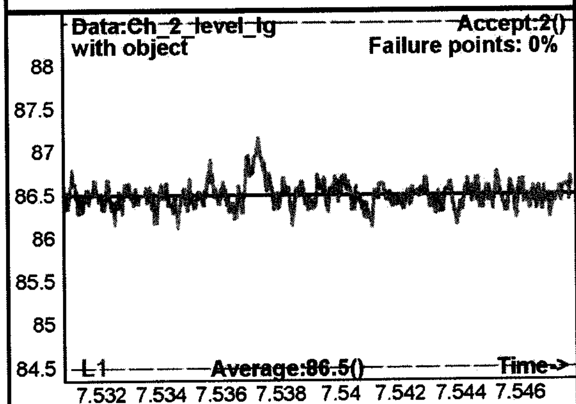
Static Calibration Test

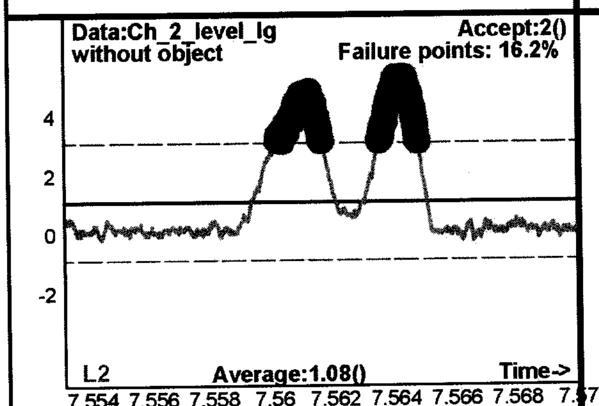
Project: Knox Mobile Home Park
Equipment: EM-61 Mark II
Grid/Location: Static Test Area

Instrument Threshold: 20%
● Outside range
— — Acceptable limits

AM test
Operator: Team B
Date: 2006/01/10







Database: q:\virginia office\ch2m hill\camp lejeune\knox mobile home park\geosoft\qc data\single qc data\110AMQCB.gdb
Line Name: L0 L1 L2

Page: 2

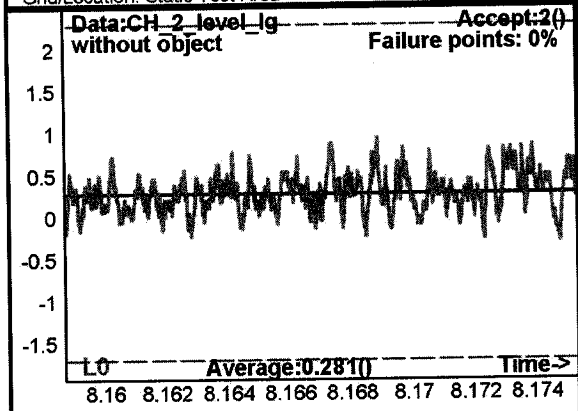
Static Test Profiles – Towed Array

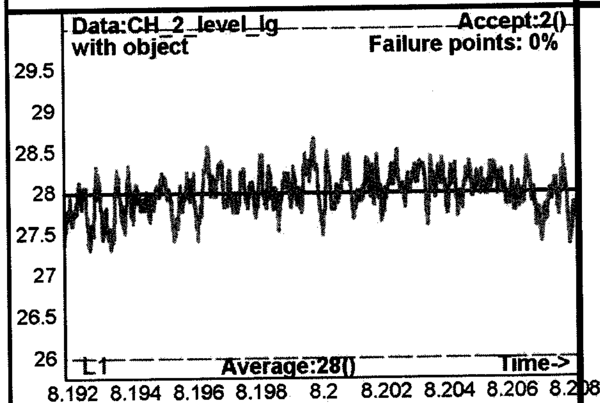
Static Calibration Test

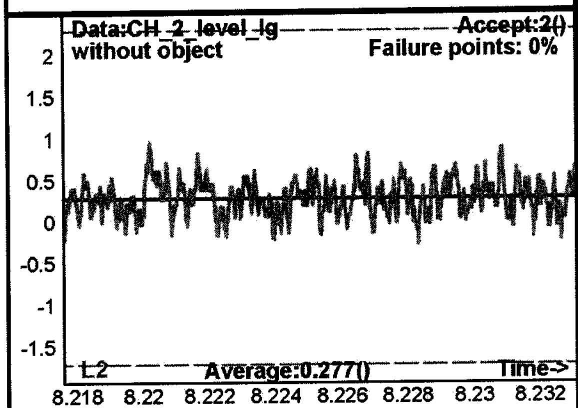
Project: Knox Mobile Home Park
Equipment: EM-61 Mark II
Grid/Location: Static Test Area

Instrument Threshold: 20%
● Outside range
— — Acceptable limits

AM test Coil 1
Operator: Team C (Towed Array)
Date: 2005/12/15







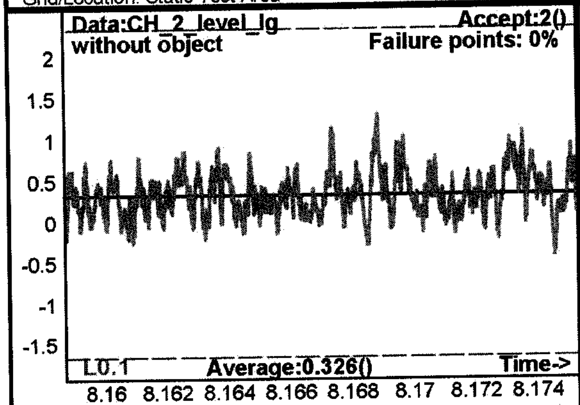
Database: q:\virginia office\ch2m hill\camp lejeune\knox mobile home park\geosoft\qc towed array\1215amqc\1215AMQC.gdb
Line Name: L0 L1 L2
Page: 2

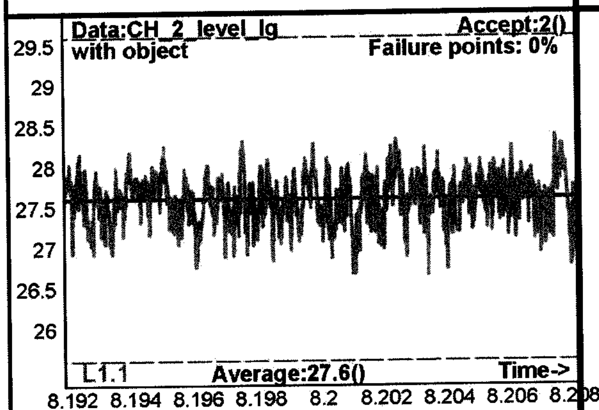
Static Calibration Test

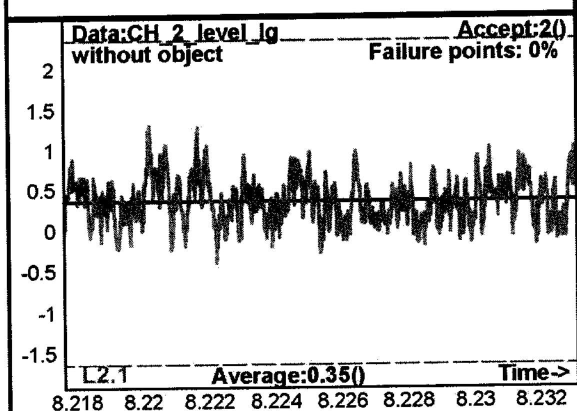
Project: Knox Mobile Home Park
Equipment: EM-61 Mark II
Grid/Location: Static Test Area

Instrument Threshold: 20%
● Outside range
— — Acceptable limits

AM test Coil 2
Operator: Team C (Towed Array)
Date: 2005/12/15







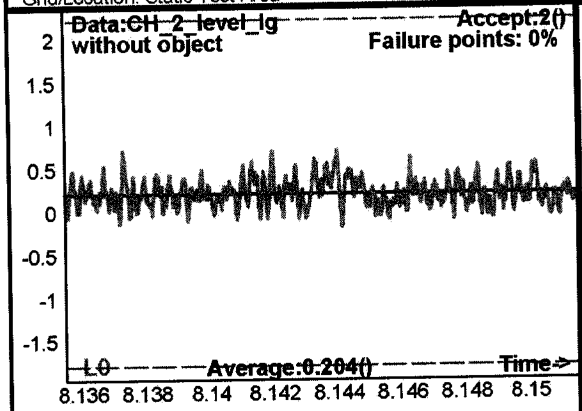
Database: q:\virginia office\ch2m hill\camp lejeune\knox mobile home park\geosoft\qc towed array\1215amqc\1215AMQC.gdb
Line Name: L0.1 L1.1 L2.1
Page: 2

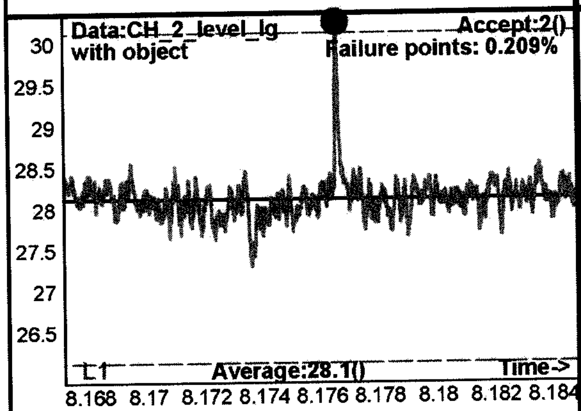
Static Calibration Test

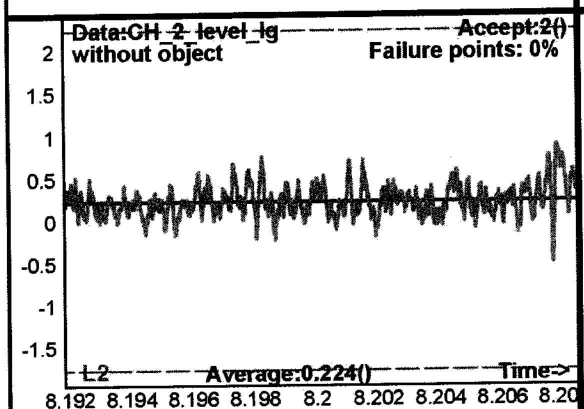
Project: Knox Mobile Home Park
Equipment: EM-61 Mark II
Grid/Location: Static Test Area

Instrument Threshold: 20%
● Outside range
—— Acceptable limits

AM test Coil 1
Operator: Team C (Towed Array)
Date: 2005/12/13







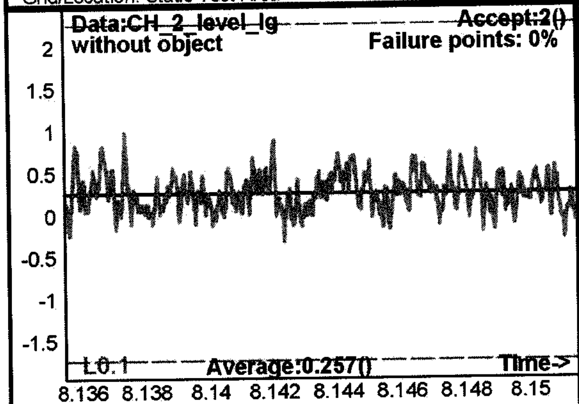
Database: q:\virginia office\ch2m hill\camp lejeune\knox mobile home park\geosoft\qc towed array\1213amqc\1213AMQC.gdb
Line Name: L0 L1 L2
Page: 2

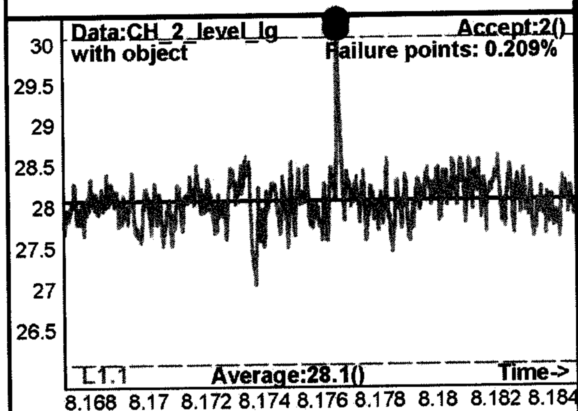
Static Calibration Test

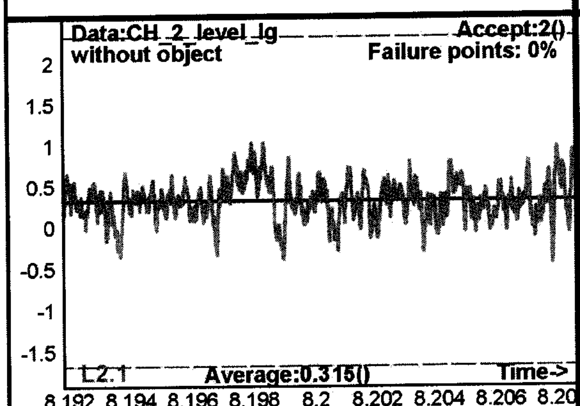
Project: Knox Mobile Home Park
Equipment: EM-61 Mark II
Grid/Location: Static Test Area

Instrument Threshold: 20%
Outside range
Acceptable limits

AM test Coil 2
Operator: Team C (Towed Array)
Date: 2005/12/13







Database: q:\virginia office\ch2m hill\camp lejeune\knox mobile home park\geosoft\qc towed array\1213amqc\1213AMQC.gdb
Line Name: L0.1 L1.1 L2.1
Page: 2

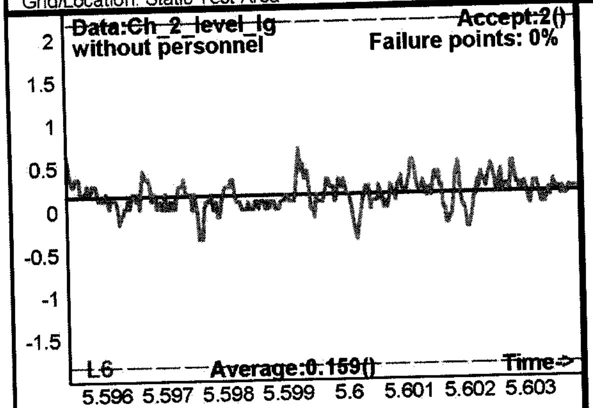
Personnel Test Profiles – Hand Towed

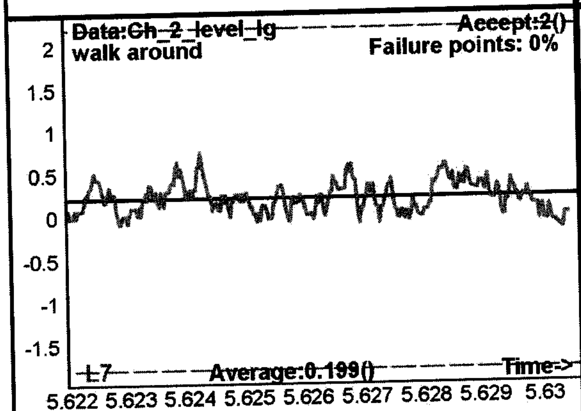
Personnel Test

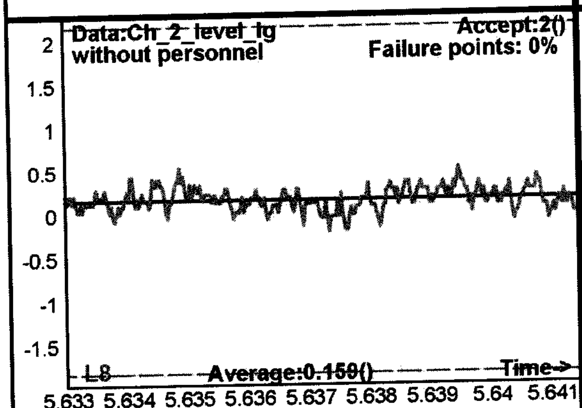
Project: Knox Mobile Home Park
Equipment: EM-61 Mark II
Grid/Location: Static Test Area

Instrument Threshold: 20%
● Outside range
— — Acceptable limits

AM test
Operator: Team B
Date: 2006/01/24







Database: q:\virginia office\ch2m hill\camp lejeune\knox mobile home park\geosoft\qc data\single qc data\124AMQCB.gdb
Line Name: L6 L7 L8

Page: 2

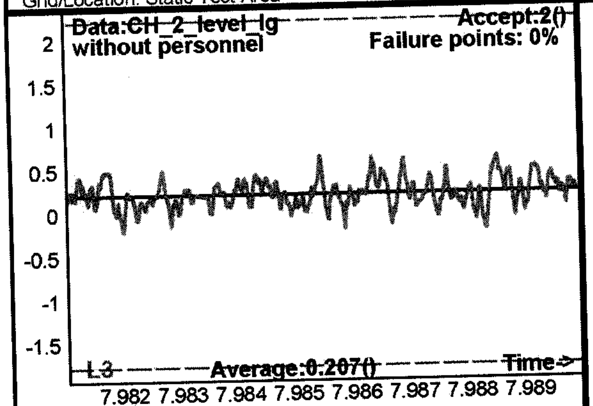
Personnel Test Profiles – Towed Array

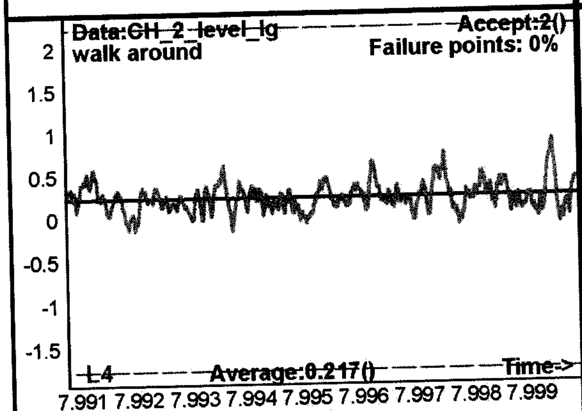
Personnel Test

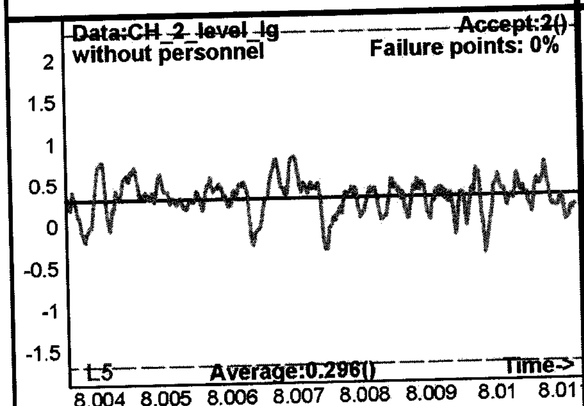
Project: Knox Mobile Home Park
Equipment: EM-61 Mark II
Grid/Location: Static Test Area

Instrument Threshold: 20%
● Outside range
— — Acceptable limits

AM test Coil 1
Operator: Team C (Towed Array)
Date: 2005/12/20







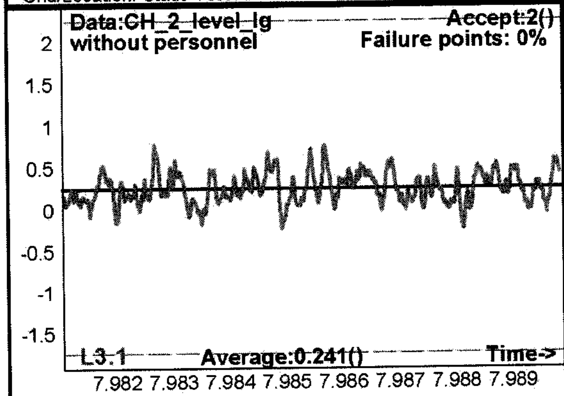
Database: q:\virginia office\ch2m hill\camp lejeune\knox mobile home park\geosoft\qc towed array\1220amqc\1220AMQC_Processed.gdb
Page: 2
Line Name: L3 L4 L5

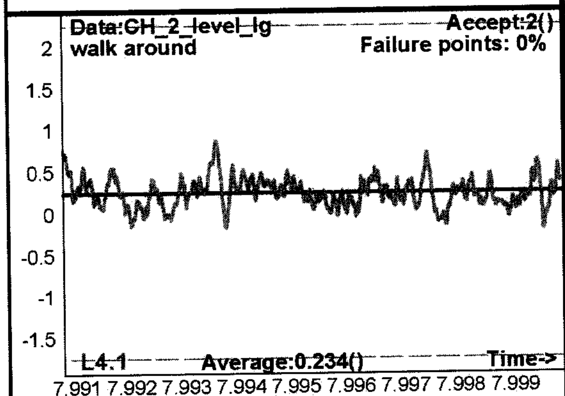
Personnel Test

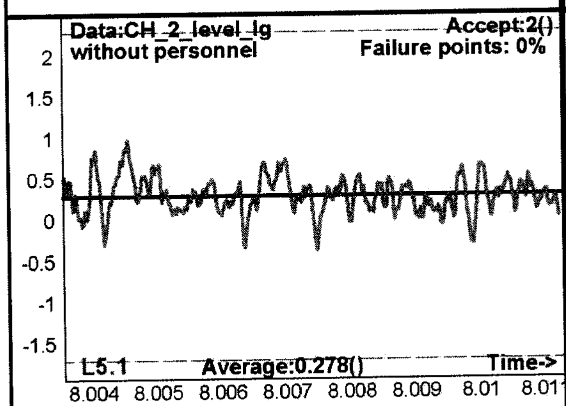
Project: Knox Mobile Home Park
Equipment: EM-61 Mark II
Grid/Location: Static Test Area

Instrument Threshold: 20%
● Outside range
— Acceptable limits

AM test Coil 2
Operator: Team C (Towed Array)
Date: 2005/12/20







Database: q:\virginia office\ch2m hill\camp lejeune\knox mobile home park\geosoft\qc towed array\1220amqc\1220AMQC_Processed.gdb
Line Name: L3.1 L4.1 L5.1

Page: 2

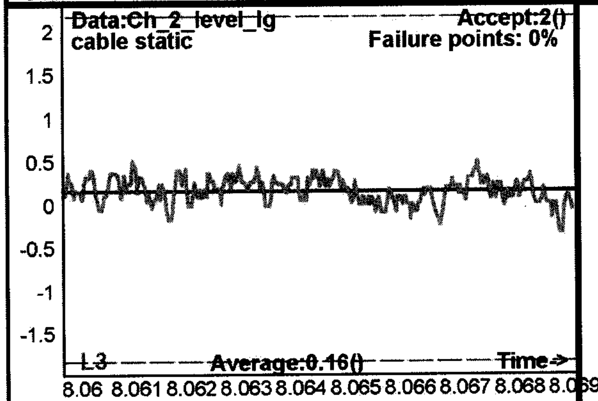
Cable Shake Test Profiles – Hand Towed

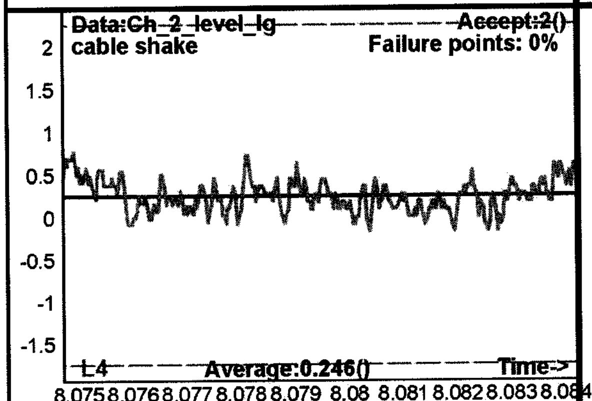
Cable Shake Test

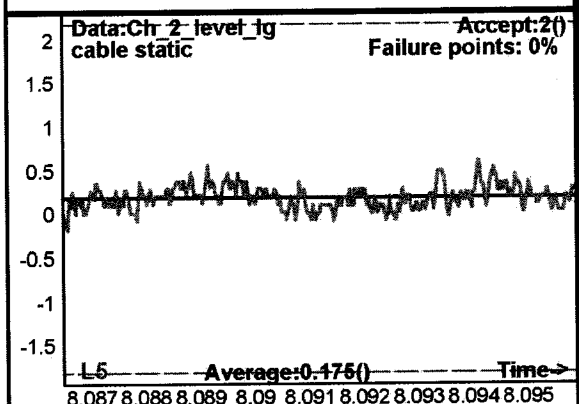
Project: Knox Mobile Home Park
Equipment: EM-61 Mark II
Grid/Location: Static Test Area

Instrument Threshold: 20%
Outside range
Acceptable limits

AM test
Operator: Team A
Date: 2006/01/05







Database: q:\virginia office\ch2m hill\camp lejeune\knox mobile home park\geosoft\qc data\single qc data\105AMQCA.gdb
Line Name: L3 L4 L5

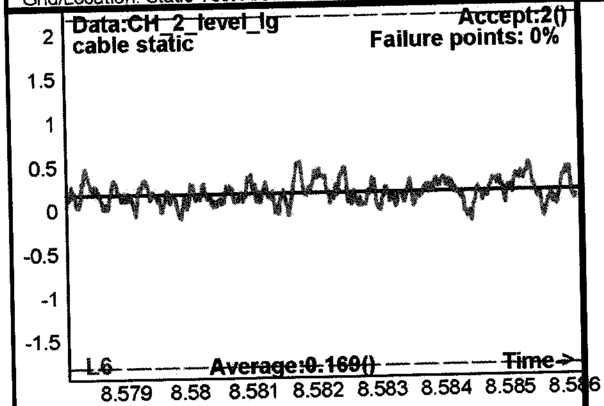
Cable Shake Test Profiles – Towed Array

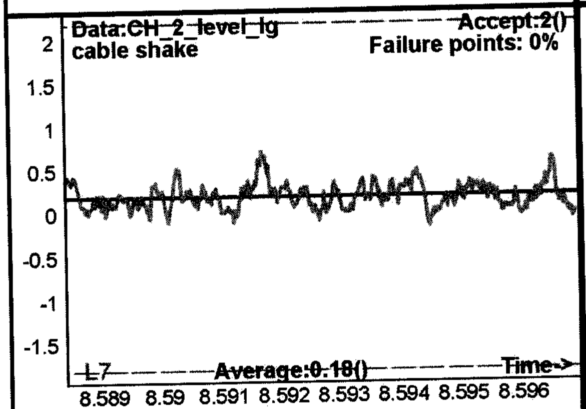
Cable Shake Test

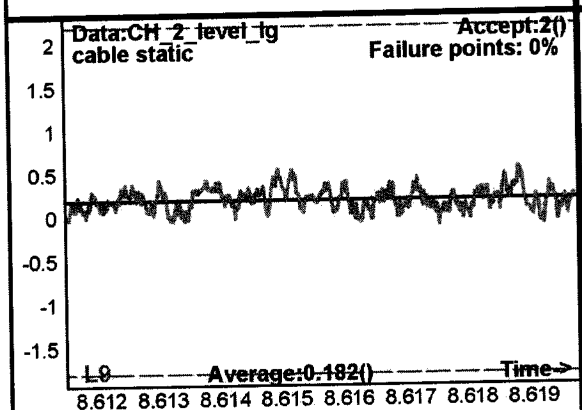
Project: Knox Mobile Home Park
Equipment: EM-61 Mark II
Grid/Location: Static Test Area

Instrument Threshold: 20%
● Outside range
— — Acceptable limits

AM test Coil 1
Operator: Team C (Towed Array)
Date: 2005/12/12







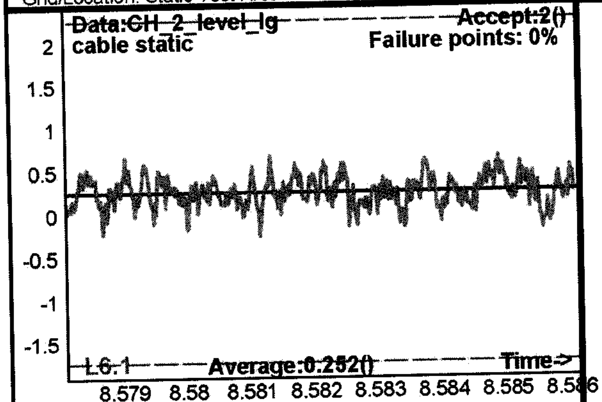
Database: q:\virginia office\ch2m hill\camp lejeune\knox mobile home park\geosoft\1212amqc\1212AMQC.gdb
Line Name: L6 L7 L9
Page: 2

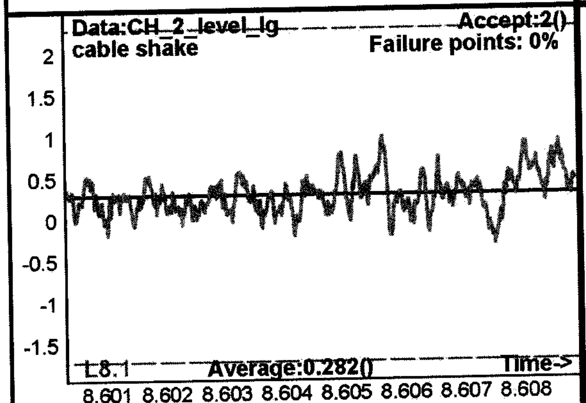
Cable Shake Test

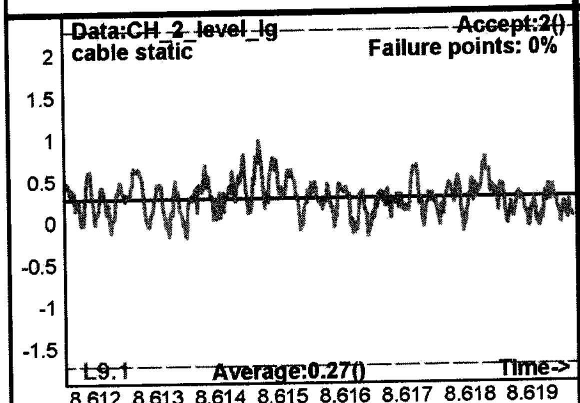
Project: Knox Mobile Home Park
Equipment: EM-61 Mark II
Grid/Location: Static Test Area

Instrument Threshold: 20%
● Outside range
— — Acceptable limits

AM test Coil 2
Operator: Team C (Towed Array)
Date: 2005/12/12



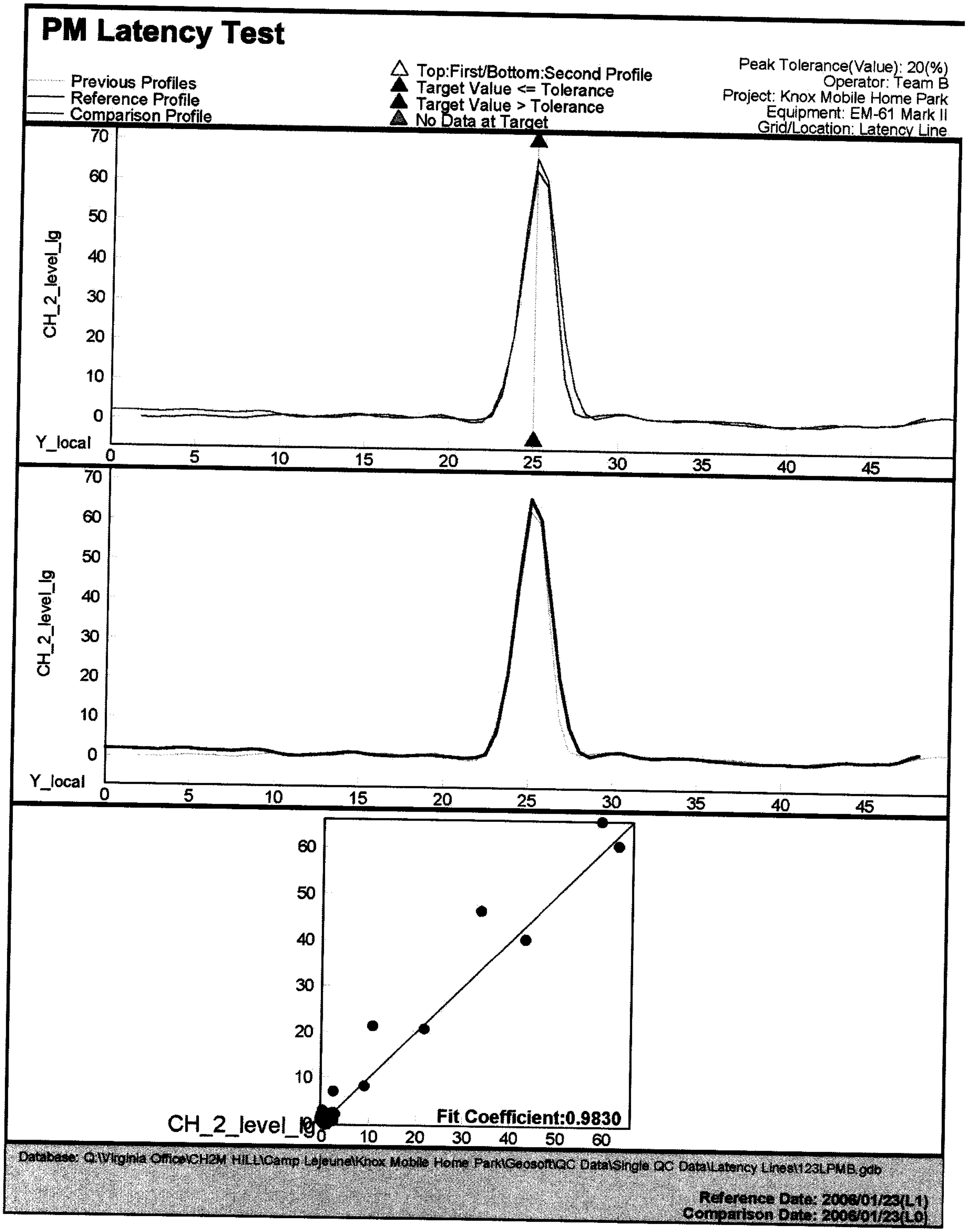




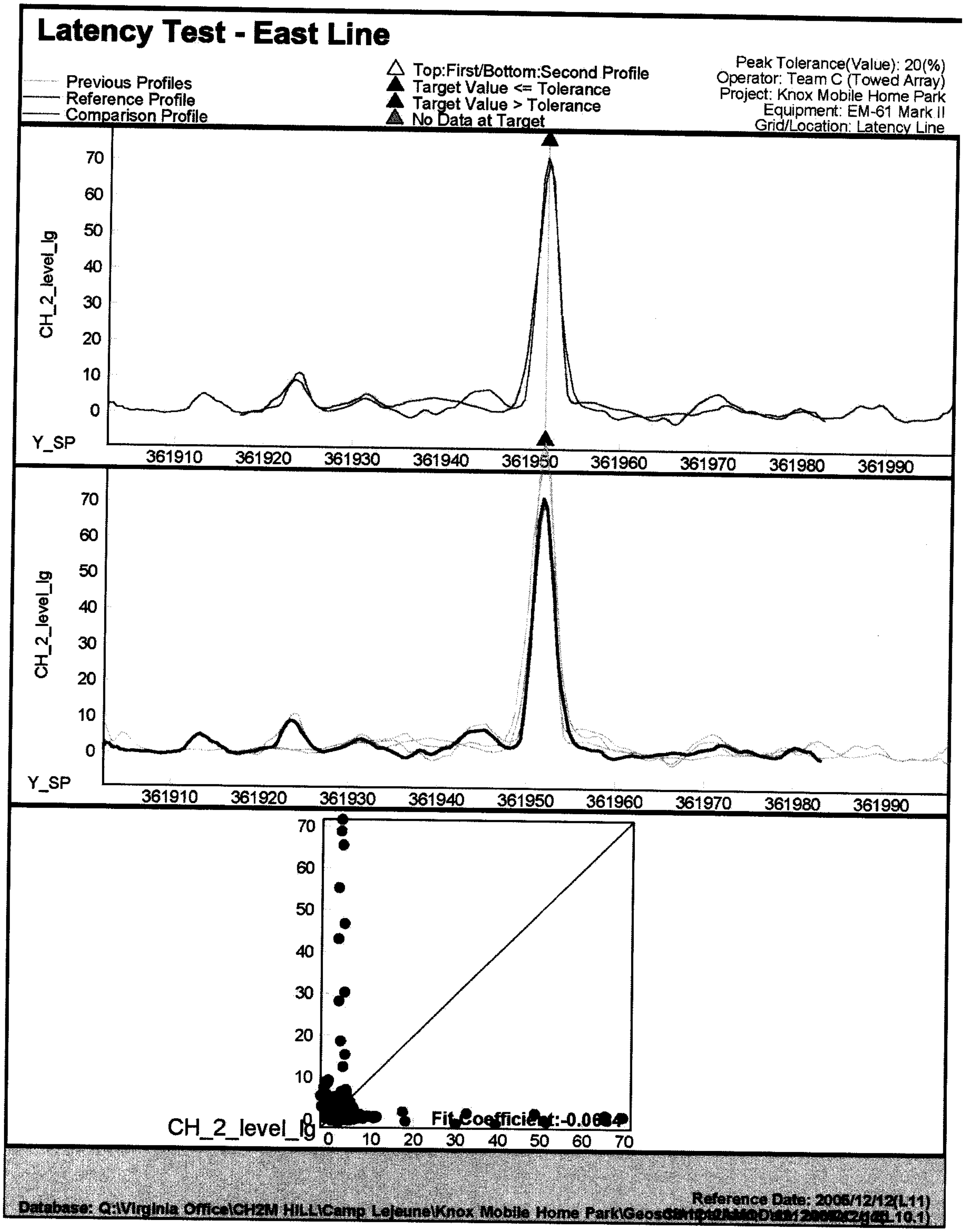
Database: q:\virginia office\ch2m hill\camp lejeune\knox mobile home park\geosoft\1212amqc\1212AMQC.gdb
Line Name: L6.1 L8.1 L9.1

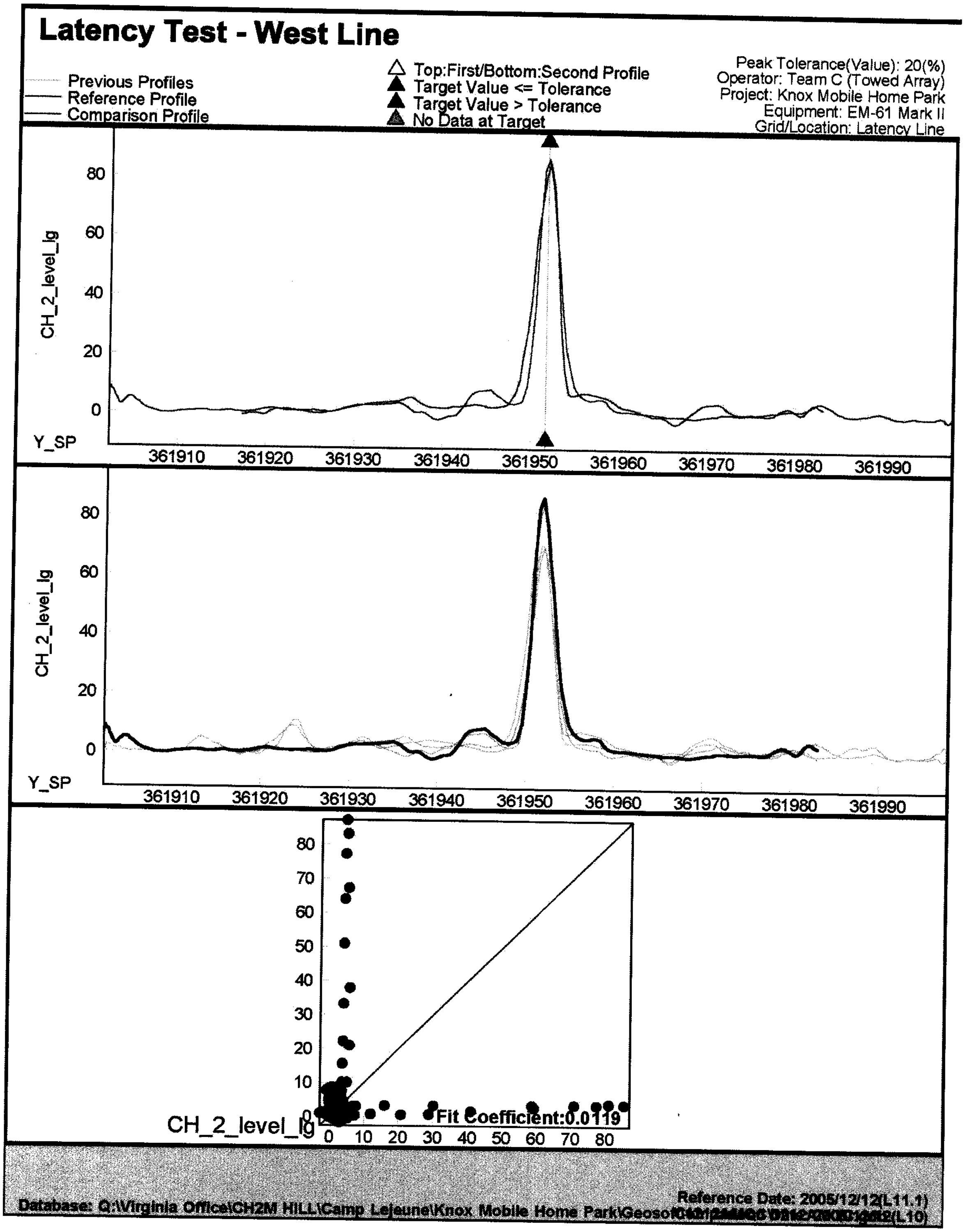
Page: 2

Latency Test Profiles – Hand Towed

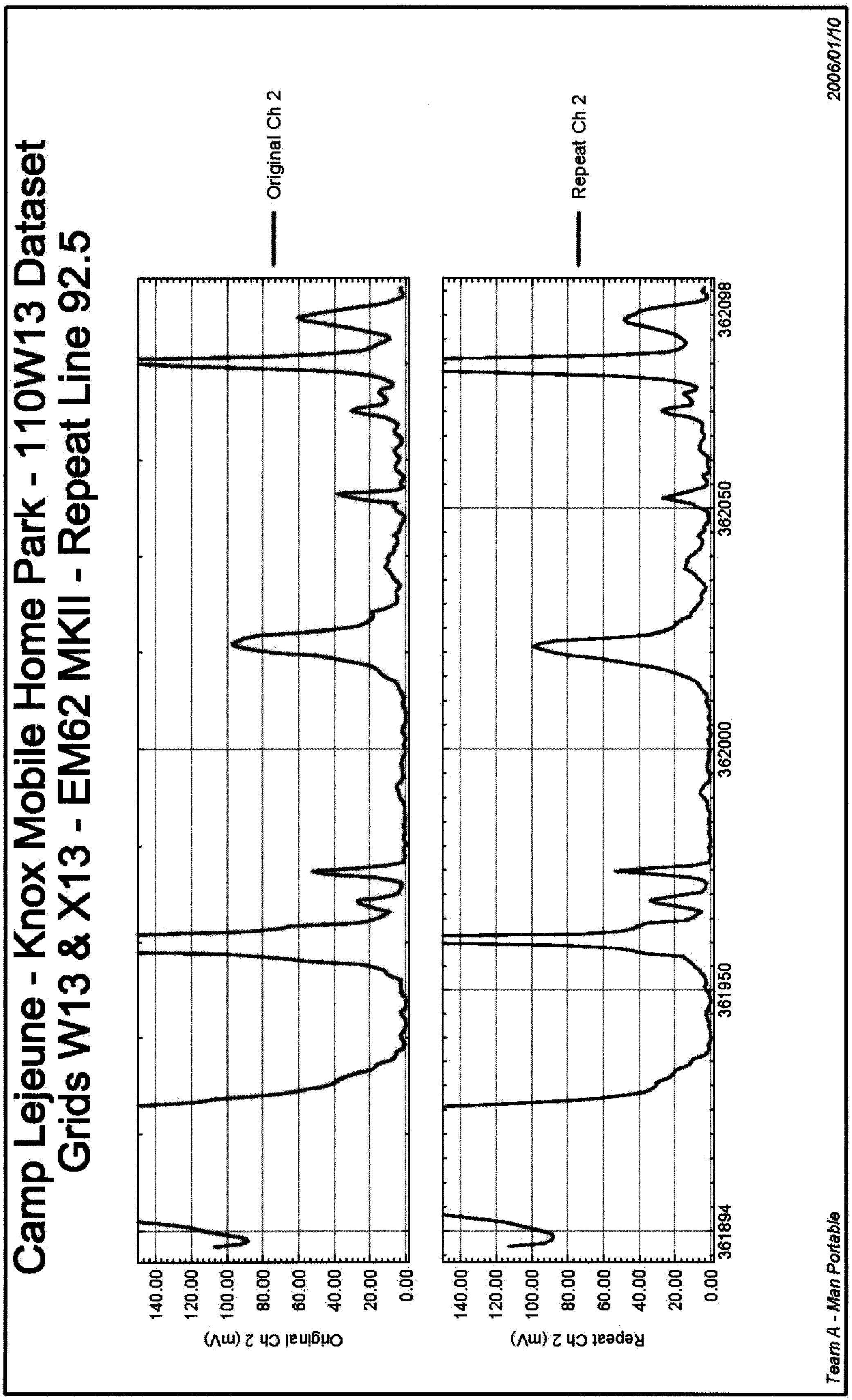

PM Latency Test
Previous Profiles
Reference Profile
Comparison Profile
Top:First/Bottom:Second Profile
Target Value <= Tolerance
Target Value > Tolerance
No Data at Target
Peak Tolerance(Value): 20(%)
Operator: Team B
Project: Knox Mobile Home Park
Equipment: EM-61 Mark II
Grid/Location: Latency Line
CH_2_level_lg
Y_local
CH_2_level_lg
Y_local
CH_2_level_lg
Fit Coefficient:0.9830
Database: Q:\Virginia Office\CH2M HILL\Camp Lejeune\Knox Mobile Home Park\Geosoft\QC Data\Single QC Data\Latency Lines\123LPMB.gdb
Reference Date: 2006/01/23(L1)
Comparison Date: 2006/01/23(L0)

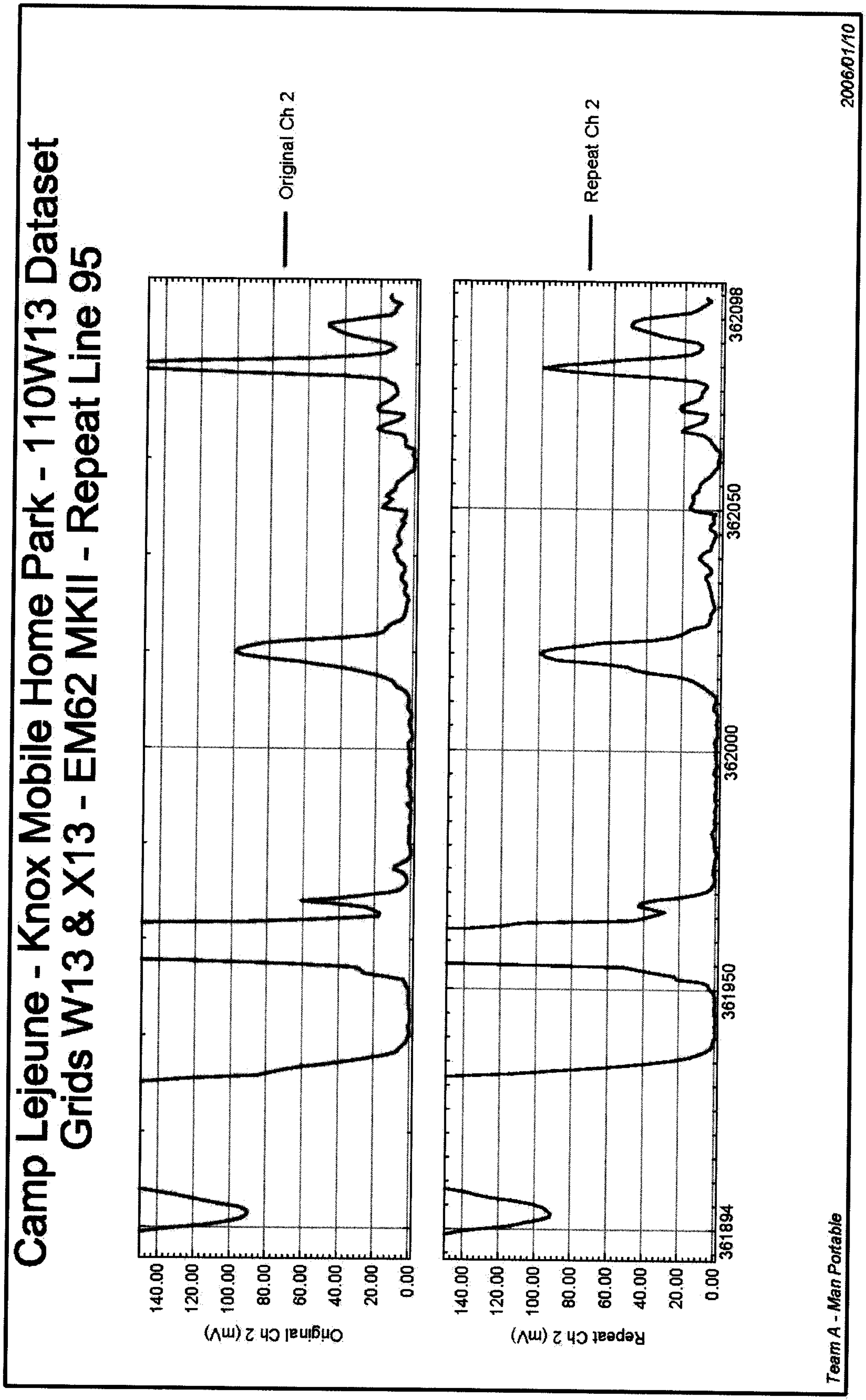
Latency Test Profiles – Towed Array


Latency Test - East Line
Previous Profiles
Reference Profile
Comparison Profile
Top:First/Bottom:Second Profile
Target Value <= Tolerance
Target Value > Tolerance
No Data at Target
Peak Tolerance(Value): 20(%)
Operator: Team C (Towed Array)
Project: Knox Mobile Home Park
Equipment: EM-61 Mark II
Grid/Location: Latency Line
CH_2_level_lg
Y_SP
361910 361920 361930 361940 361950 361960 361970 361980 361990
0 10 20 30 40 50 60 70
CH_2_level_lg
Reference Date: 2006/12/12(L11)
Database: Q:\Virginia Office\CH2M HILL\Camp Lejeune\Knox Mobile Home Park\Geos

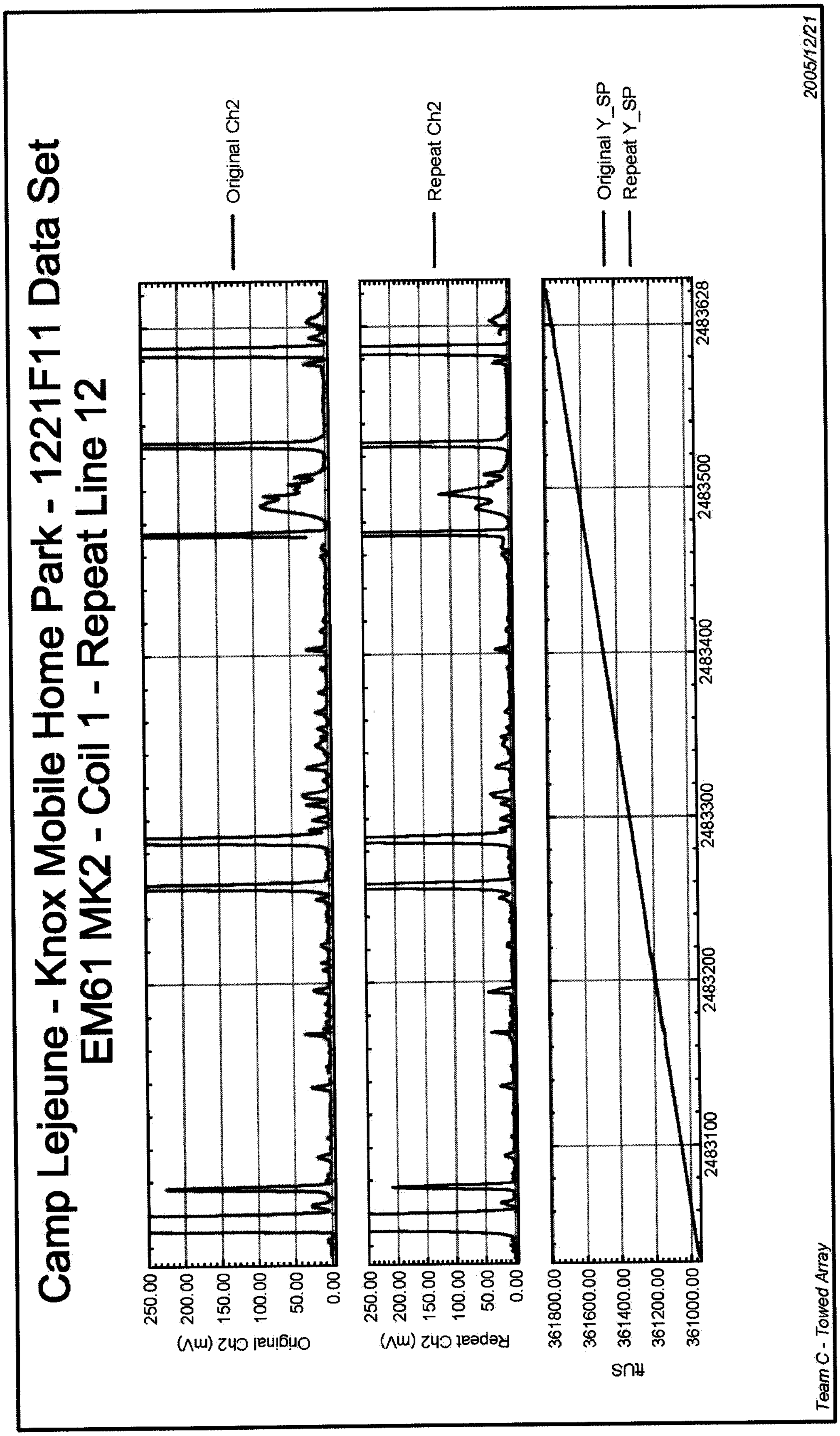

Latency Test - West Line
Previous Profiles
Reference Profile
Comparison Profile
Top:First/Bottom:Second Profile
Target Value <= Tolerance
Target Value > Tolerance
No Data at Target
Peak Tolerance(Value): 20(%)
Operator: Team C (Towed Array)
Project: Knox Mobile Home Park
Equipment: EM-61 Mark II
Grid/Location: Latency Line
CH_2_level_lg
Y_SP
361910 361920 361930 361940 361950 361960 361970 361980 361990
Fit Coefficient:0.0119
Reference Date: 2005/12/12(L11.1)
Database: Q:\Virginia Office\CH2M HILL\Camp Lejeune\Knox Mobile Home Park\Geosoft

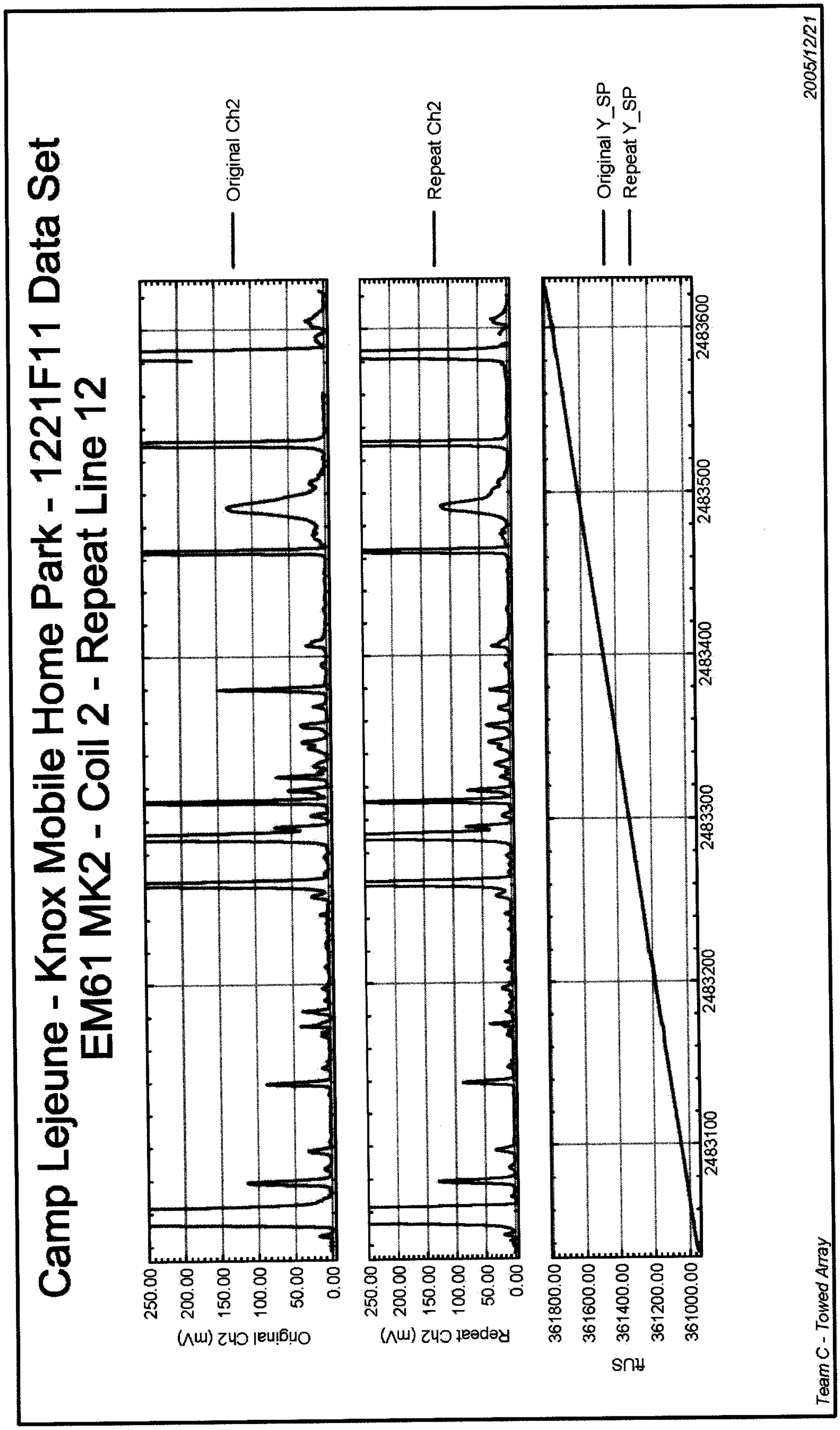
Repeat Line Profiles – Hand Towed


Camp Lejeune - Knox Mobile Home Park - 110W13 Dataset
Grids W13 & X13 - EM62 MKII - Repeat Line 92.5
Original Ch 2
Original Ch 2 (mV)
140.00
120.00
100.00
80.00
60.00
40.00
20.00
0.00
Repeat Ch 2
Repeat Ch 2 (mV)
361894
361950
362000
362050
362098
Team A - Man Portable
2006/01/10

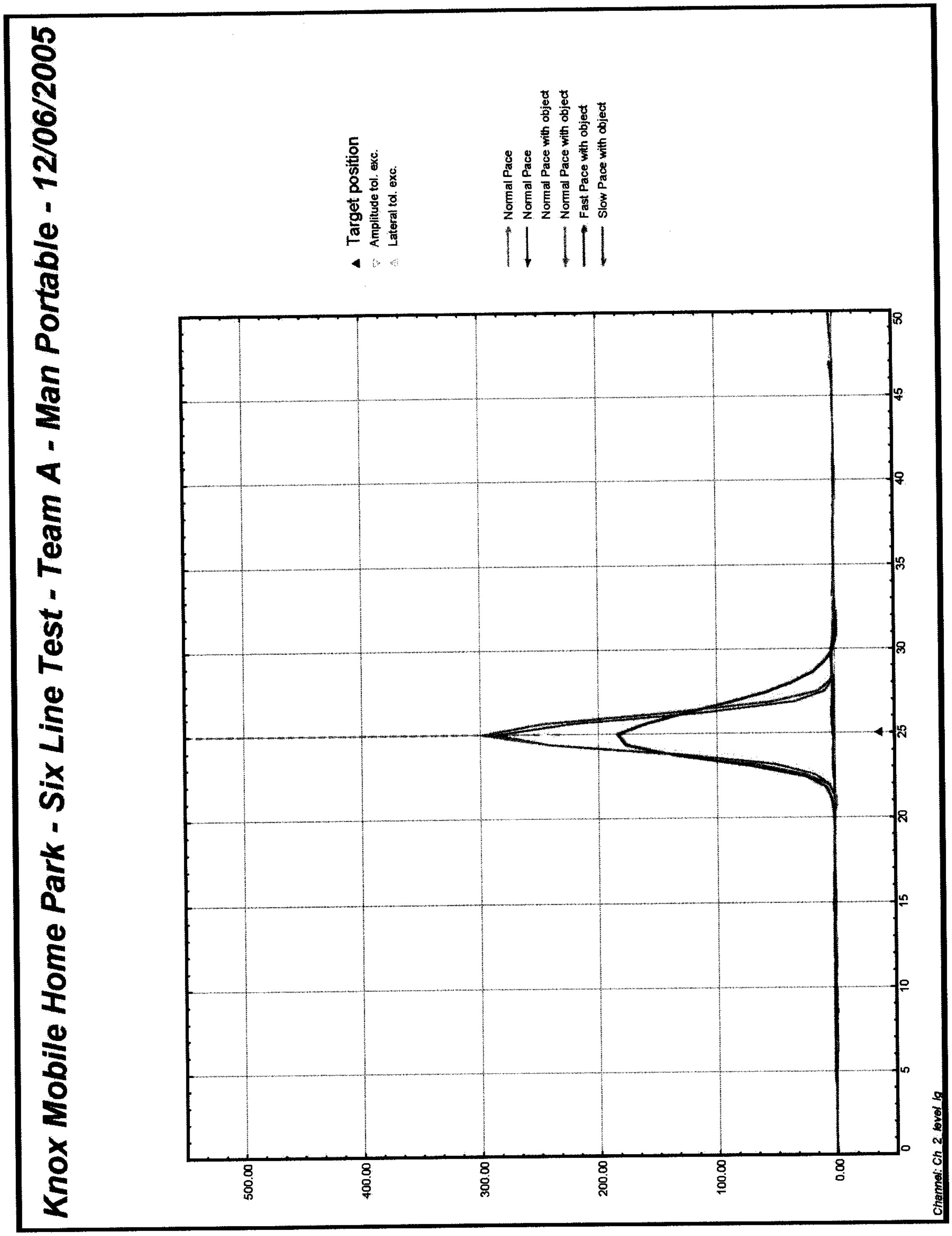

Camp Lejeune - Knox Mobile Home Park - 110W13 Dataset
Grids W13 & X13 - EM62 MKII - Repeat Line 95
Original Ch 2
Repeat Ch 2
Original Ch 2 (mV)
Repeat Ch 2 (mV)
140.00
120.00
100.00
80.00
60.00
40.00
20.00
0.00
361894
361950
362000
362050
362098
Team A - Man Portable
2006/01/10

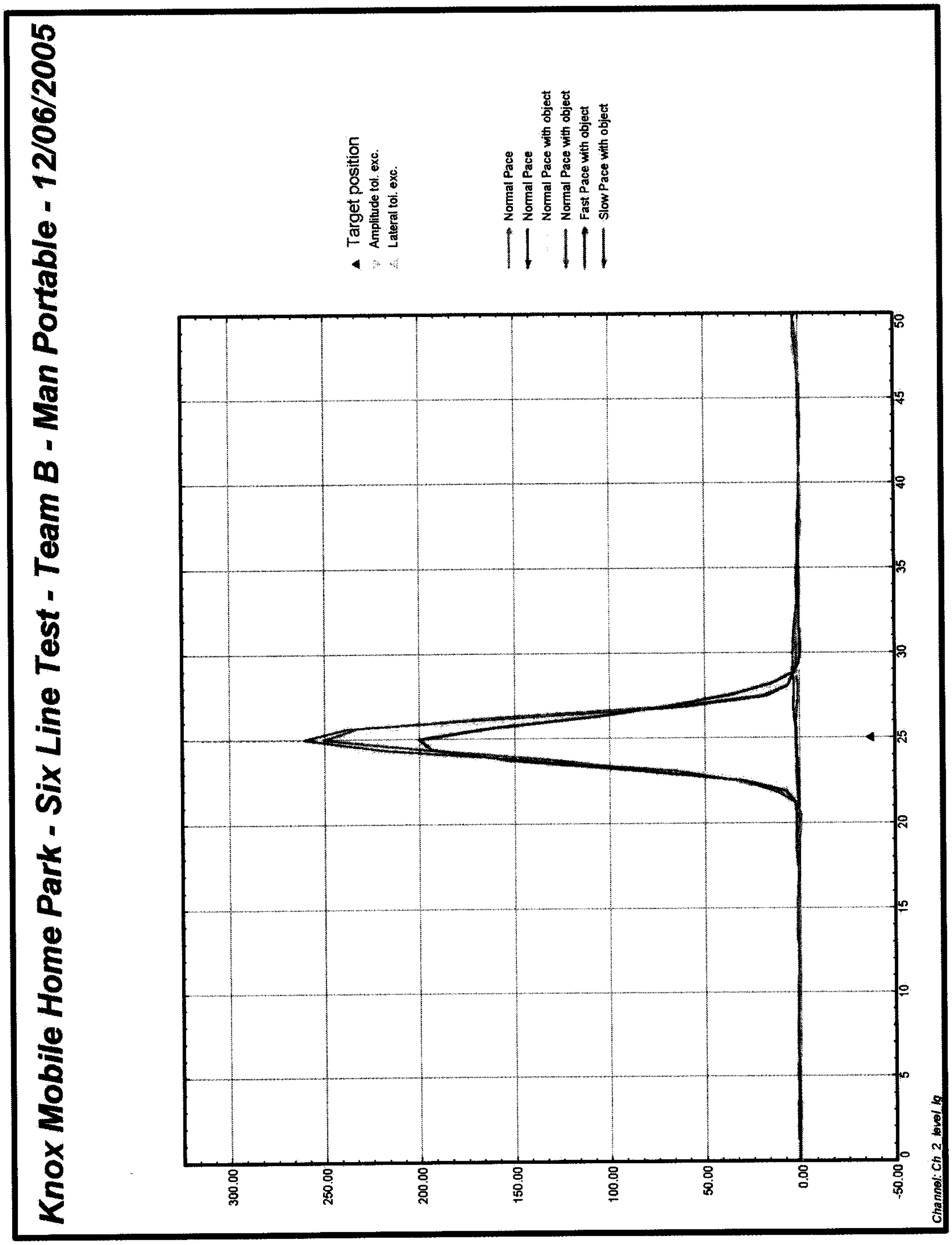
Repeat Line Profiles – Towed Array


Camp Lejeune - Knox Mobile Home Park - 1221F11 Data Set
EM61 MK2 - Coil 1 - Repeat Line 12
Original Ch2
Repeat Ch2
Original Y_SP
Repeat Y_SP
Original Ch2 (mV)
250.00
200.00
150.00
100.00
50.00
0.00
Repeat Ch2 (mV)
250.00
200.00
150.00
100.00
50.00
0.00
ftUS
361800.00
361600.00
361400.00
361200.00
361000.00
2483100
2483200
2483300
2483400
2483500
2483628
2005/12/21
Team C - Towed Array

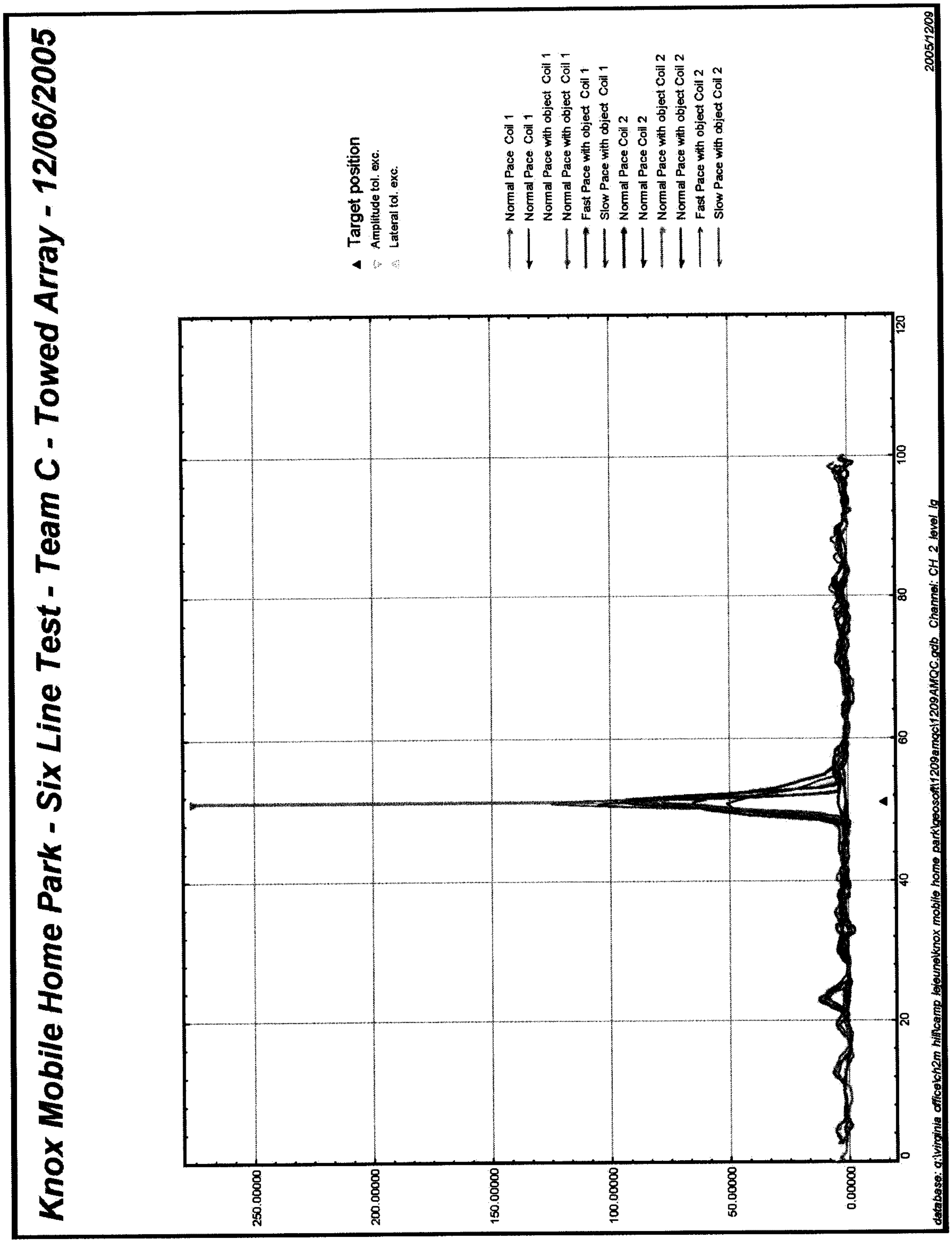

Camp Lejeune - Knox Mobile Home Park - 1221F11 Data Set
EM61 MK2 - Coil 2 - Repeat Line 12
Original Ch2
Repeat Ch2
Original Y_SP
Repeat Y_SP
Original Ch2 (mV)
Repeat Ch2 (mV)
ftUS
250.00
200.00
150.00
100.00
50.00
0.00
361800.00
361600.00
361400.00
361200.00
361000.00
2483100
2483200
2483300
2483400
2483500
2483600
2005/12/21
Team C - Towed Array

Six Line Test Profiles – Hand Towed


Knox Mobile Home Park - Six Line Test - Team A - Man Portable - 12/06/2005
Target position
Amplitude tol. exc.
Lateral tol. exc.
Normal Pace
Normal Pace
Normal Pace with object
Normal Pace with object
Fast Pace with object
Slow Pace with object
500.00
400.00
300.00
200.00
100.00
0.00
0
5
10
15
20
25
30
35
40
45
50
Channel: Ch 2 level lg


Knox Mobile Home Park - Six Line Test - Team B - Man Portable - 12/06/2005
Target position
Amplitude tol. exc.
Lateral tol. exc.
Normal Pace
Normal Pace
Normal Pace with object
Normal Pace with object
Fast Pace with object
Slow Pace with object
300.00
250.00
200.00
150.00
100.00
50.00
0.00
-50.00
0
5
10
15
20
25
30
35
40
45
50
Channel: Ch 2 level lg

Six Line Test Profiles – Towed Array


Knox Mobile Home Park - Six Line Test - Team C - Towed Array - 12/06/2005
Target position
Amplitude tol. exc.
Lateral tol. exc.
Normal Pace Coil 1
Normal Pace Coil 1
Normal Pace with object Coil 1
Normal Pace with object Coil 1
Fast Pace with object Coil 1
Slow Pace with object Coil 1
Normal Pace Coil 2
Normal Pace Coil 2
Normal Pace with object Coil 2
Normal Pace with object Coil 2
Fast Pace with object Coil 2
Slow Pace with object Coil 2
250.00000
200.00000
150.00000
100.00000
50.00000
0.00000
0
20
40
60
80
100
120
2005/12/09

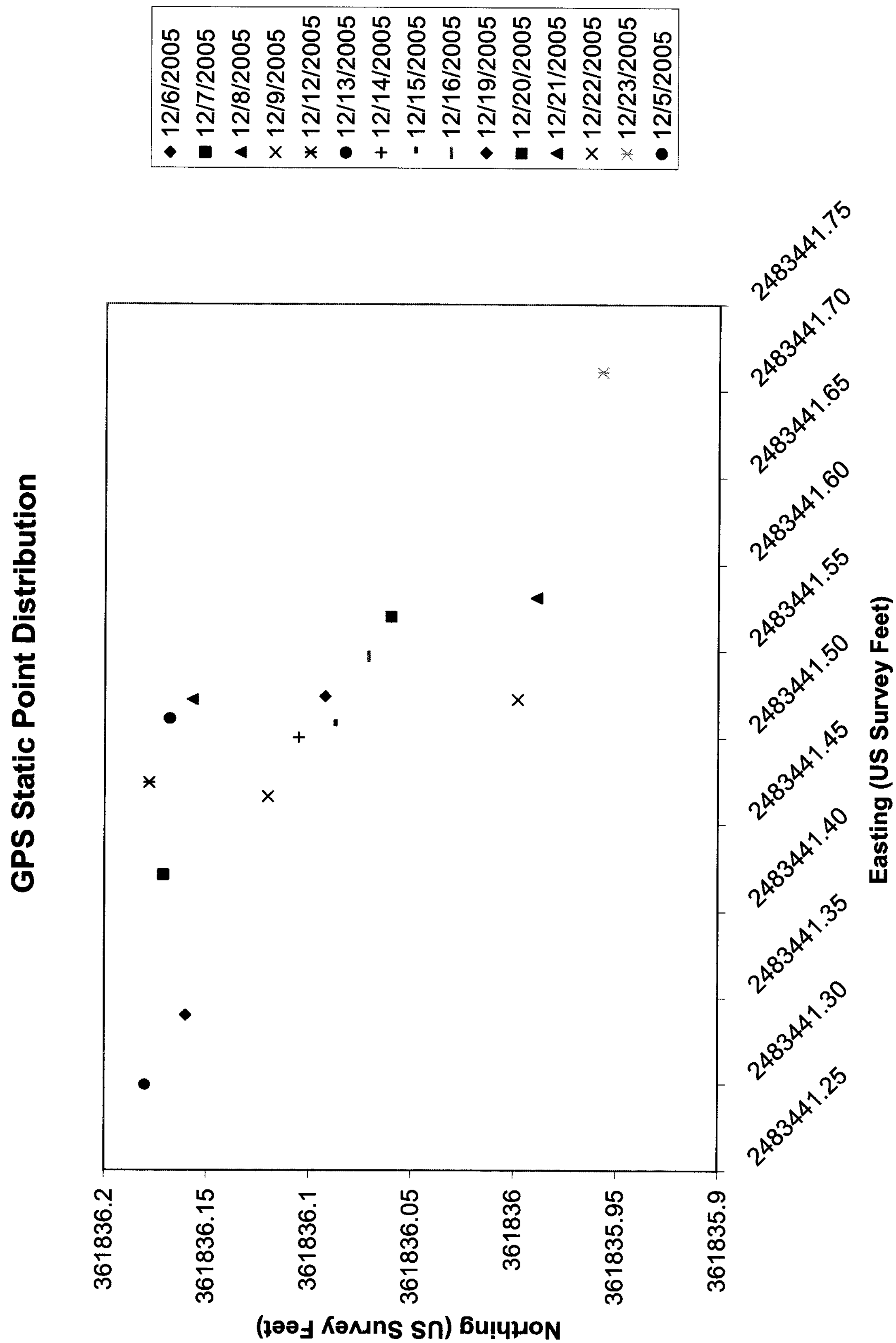
APPENDIX C

GPS QC Tests

Camp Lejeune, North Carolina
Knox Mobile Home Park
GPS Static Test Data
December 5, 2005 – December 23, 2005

Date	Northing	Easting	Difference Easting	Difference Northing	Absolute Offset
12/5/2005	**361836.18**	**2483441.3**			
12/6/2005	361836.16	2483441.34	-0.020	0.040	0.045
12/7/2005	361836.171	2483441.421	-0.009	0.121	0.121
12/8/2005	361836.157	2483441.522	-0.023	0.222	0.223
12/9/2005	361836.12	2483441.466	-0.060	0.166	0.177
12/12/2005	361836.178	2483441.474	-0.002	0.174	0.174
12/13/2005	361836.168	2483441.511	-0.012	0.211	0.211
12/14/2005	361836.105	2483441.5	-0.075	0.200	0.214
12/15/2005	361836.087	2483441.507	-0.093	0.207	0.227
12/16/2005	361836.071	2483441.547	-0.109	0.247	0.270
12/19/2005	361836.092	2483441.524	-0.088	0.224	0.241
12/20/2005	361836.06	2483441.57	-0.120	0.270	0.295
12/21/2005	361835.989	2483441.581	-0.191	0.281	0.340
12/22/2005	361835.998	2483441.64	-0.182	0.340	0.386
12/23/2005	361835.957	2483441.711	-0.223	0.411	0.468
Average:	361836.0995	2483441.508	-0.086	0.222	0.242
Stnd. Dev.	0.072499526	0.090150058			

Note: Differences and offsets were calculated against the 12/5/05 reading. Average and standard deviation calculations include all days. All units are in feet.

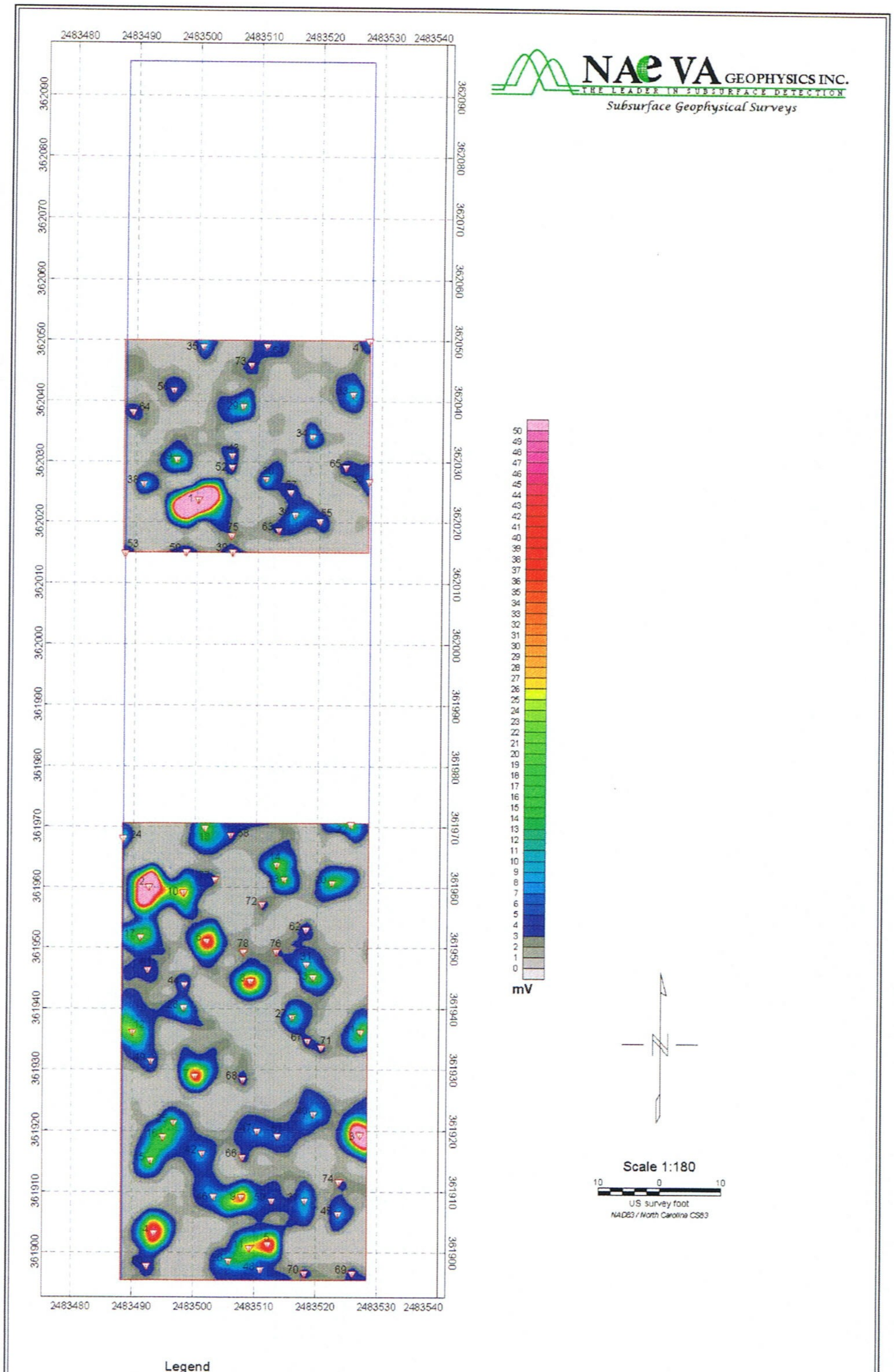

GPS Static Point Distribution
Northing (US Survey Feet)
Easting (US Survey Feet)
361836.2
361836.15
361836.1
361836.05
361836
361835.95
361835.9
2483441.25
2483441.30
2483441.35
2483441.40
2483441.45
2483441.50
2483441.55
2483441.60
2483441.65
2483441.70
2483441.75
12/6/2005
12/7/2005
12/8/2005
12/9/2005
12/12/2005
12/13/2005
12/14/2005
12/15/2005
12/16/2005
12/19/2005
12/20/2005
12/21/2005
12/22/2005
12/23/2005
12/5/2005

APPENDIX D

GPO Color Contour Maps and Target Lists

GPO – Hand Towed Team A

Contour Map and Target List



CH2M HILL

EM61 MK2 Channel 2 - Man Portable
GPO - Team A
Knox Mobile Home Park
Camp Legeune, North Carolina

Date of Survey: December 6, 2005

CH2M Hill
GPO - Team A - Man Portable
Knox Mobile Home Park
Camp Lejeune, North Carolina
Date of Survey: December 6, 2005

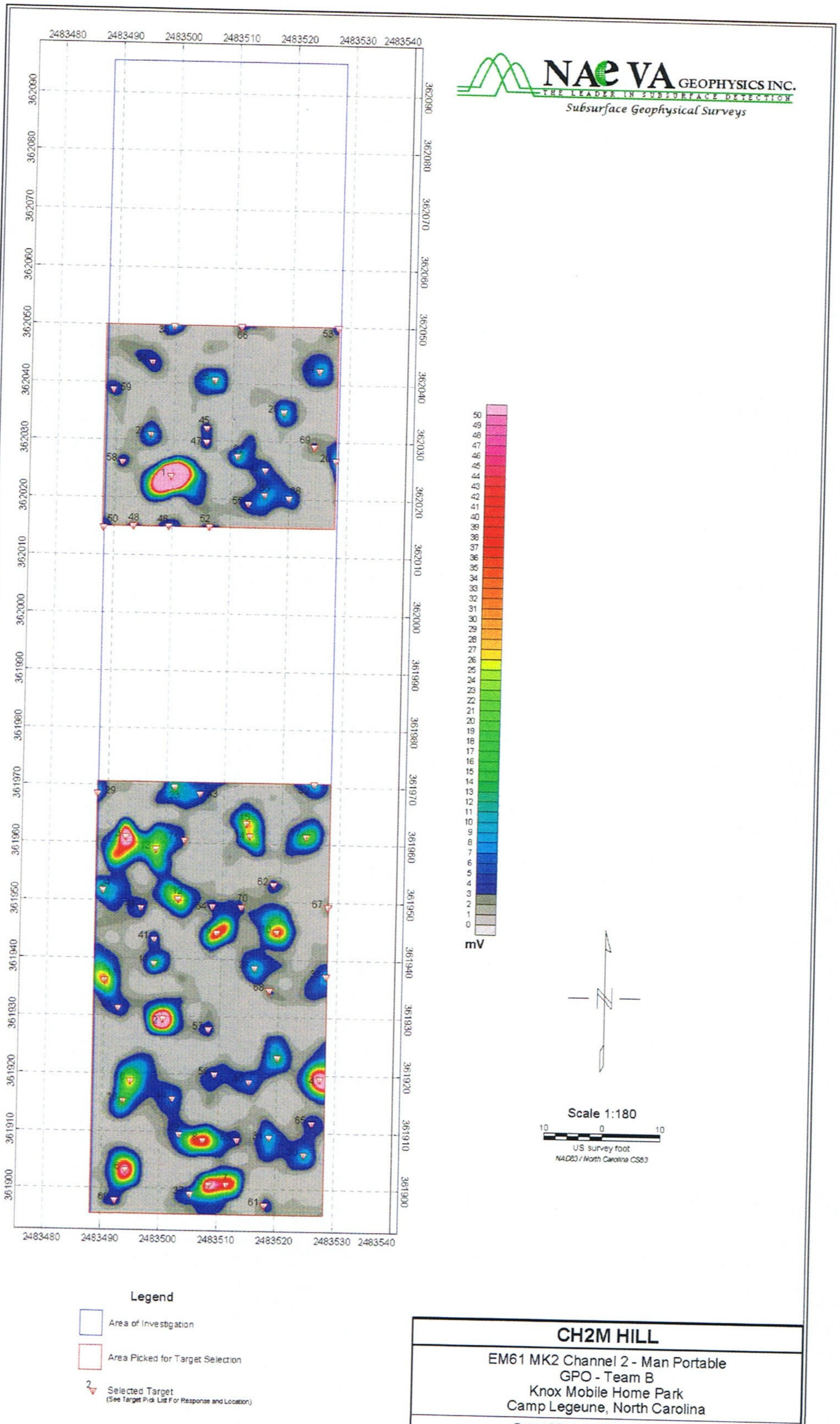
Target Pick Table (EM-61 MK2 - Channel 2)

Targets	Target ID	NAD 83/North Carolina State Planes X (USft)	NAD 83/North Carolina State Planes Y (USft)	Grid Value (mV)
1	GPOA_1	2483500.20	362023.80	210.31
2	GPOA_2	2483492.55	361960.13	112.68
3	GPOA_3	2483527.20	361919.40	98.86
4	GPOA_4	2483493.60	361903.20	51.22
5	GPOA_5	2483512.20	361901.40	49.20
6	GPOA_6	2483502.00	361951.20	45.49
7	GPOA_7	2483500.20	361929.00	42.36
8	GPOA_8	2483509.20	361944.60	40.75
9	GPOA_9	2483507.85	361909.22	35.13
10	GPOA_10	2483498.19	361959.22	29.82
11	GPOA_11	2483509.20	361900.80	26.89
12	GPOA_12	2483490.00	361936.20	24.43
13	GPOA_13	2483519.40	361945.20	20.22
14	GPOA_14	2483513.40	361963.80	19.73
15	GPOA_15	2483493.00	361915.20	19.24
16	GPOA_16	2483495.02	361919.04	19.22
17	GPOA_17	2483491.20	361951.80	16.91
18	GPOA_18	2483501.60	361969.83	16.33
19	GPOA_19	2483496.60	362030.40	16.27
20	GPOA_20	2483522.40	361960.80	16.13
21	GPOA_21	2483527.20	361936.20	15.74
22	GPOA_22	2483525.40	361970.40	15.68
23	GPOA_23	2483514.60	361961.40	15.19
24	GPOA_24	2483488.28	361968.09	14.87
25	GPOA_25	2483496.76	361921.42	14.84
26	GPOA_26	2483505.78	361898.65	14.71
27	GPOA_27	2483516.02	361938.69	13.84
28	GPOA_28	2483498.27	361940.20	13.82
29	GPOA_29	2483507.35	362039.24	13.19
30	GPOA_30	2483511.17	362027.24	11.63
31	GPOA_31	2483518.28	361947.32	11.59
32	GPOA_32	2483527.97	362026.79	11.22
33	GPOA_33	2483525.28	362041.19	10.83
34	GPOA_34	2483518.70	362034.24	10.24
35	GPOA_35	2483500.80	362049.00	10.08
36	GPOA_36	2483515.97	362021.25	10.03

37	GPOA_37	2483518.20	361908.60	9.98
38	GPOA_38	2483491.21	362026.39	9.28
39	GPOA_39	2483505.82	362015.10	9.17
40	GPOA_40	2483519.58	361922.77	8.90
41	GPOA_41	2483527.88	362049.87	8.89
42	GPOA_42	2483501.40	361916.40	8.54
43	GPOA_43	2483505.61	362031.10	8.51
44	GPOA_44	2483498.40	361944.00	8.01
45	GPOA_45	2483523.62	361906.36	8.00
46	GPOA_46	2483503.28	361909.28	7.80
47	GPOA_47	2483510.40	361920.00	7.51
48	GPOA_48	2483511.00	361897.20	7.16
49	GPOA_49	2483493.00	361931.40	7.16
50	GPOA_50	2483498.22	362015.07	6.51
51	GPOA_51	2483513.72	361919.20	6.41
52	GPOA_52	2483505.60	362029.20	6.40
53	GPOA_53	2483488.28	362014.90	6.14
54	GPOA_54	2483511.19	362049.07	6.04
55	GPOA_55	2483520.00	362020.20	6.01
56	GPOA_56	2483496.00	362041.80	6.00
57	GPOA_57	2483515.20	362025.00	5.69
58	GPOA_58	2483505.78	361968.70	5.41
59	GPOA_59	2483512.80	361908.60	5.28
60	GPOA_60	2483492.40	361897.80	5.09
61	GPOA_61	2483492.40	361946.40	4.70
62	GPOA_62	2483518.20	361953.00	4.51
63	GPOA_63	2483513.28	362018.70	4.20
64	GPOA_64	2483489.40	362038.20	4.16
65	GPOA_65	2483524.20	362029.20	4.08
66	GPOA_66	2483508.00	361915.80	4.02
67	GPOA_67	2483518.55	361934.73	4.01
68	GPOA_68	2483508.00	361928.40	3.90
69	GPOA_69	2483526.00	361896.60	3.89
70	GPOA_70	2483518.20	361896.60	3.69
71	GPOA_71	2483520.78	361933.65	3.64
72	GPOA_72	2483511.00	361957.20	3.54
73	GPOA_73	2483508.60	362046.00	3.43
74	GPOA_74	2483523.80	361911.63	3.19
75	GPOA_75	2483505.60	362017.80	3.14
76	GPOA_76	2483513.40	361949.40	3.11
77	GPOA_77	2483503.28	361961.38	3.03
78	GPOA_78	2483508.00	361949.40	3.00

GPO – Hand Towed Team B

Contour Map and Target List



CH2M HILL

EM61 MK2 Channel 2 - Man Portable
GPO - Team B
Knox Mobile Home Park
Camp Legeune, North Carolina

Date of Survey: December 6, 2005

CH2M Hill
GPO - Team B - Man Portable
Knox Mobile Home Park
Camp Lejeune, North Carolina
Date of Survey: December 6, 2005

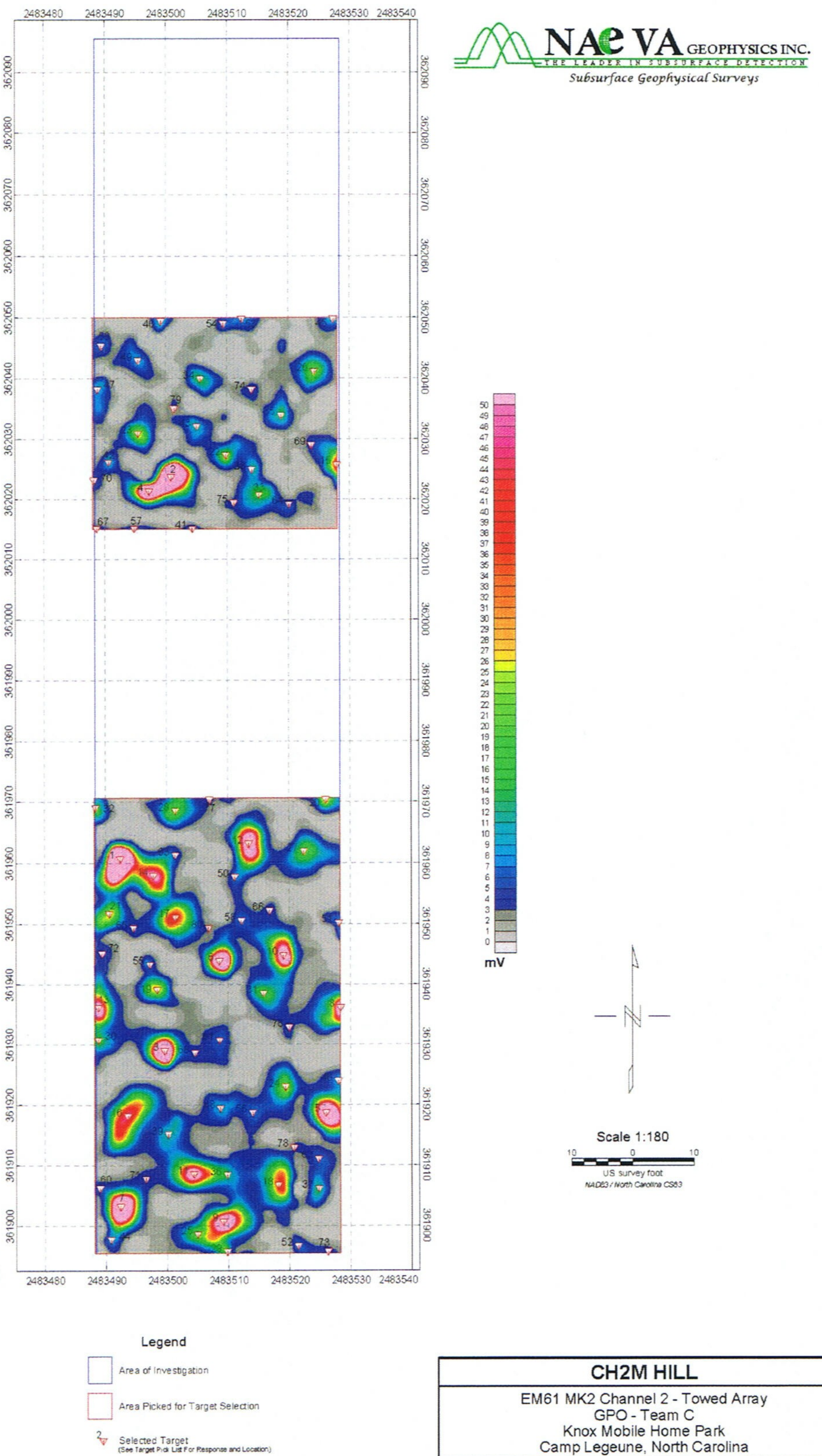
Target Pick Table (EM-61 MK2 - Channel 2)

Targets	Target ID	NAD 83/North Carolina State Planes		Grid Value (mV)
		X (USft)	Y (USft)	
1	GPOB_1	2483499.60	362023.80	261.17
2	GPOB_2	2483500.20	361929.60	103.92
3	GPOB_3	2483493.23	361961.02	78.51
4	GPOB_4	2483527.39	361919.43	70.02
5	GPOB_5	2483508.60	361900.80	59.86
6	GPOB_6	2483494.20	361903.20	57.97
7	GPOB_7	2483511.60	361900.80	45.87
8	GPOB_8	2483507.40	361908.60	45.36
9	GPOB_9	2483509.20	361944.60	44.32
10	GPOB_10	2483519.49	361944.86	37.89
11	GPOB_11	2483490.00	361936.20	33.70
12	GPOB_12	2483502.38	361950.43	29.15
13	GPOB_13	2483498.42	361958.95	28.03
14	GPOB_14	2483514.60	361961.40	27.81
15	GPOB_15	2483513.89	361963.54	27.25
16	GPOB_16	2483494.80	361918.80	27.20
17	GPOB_17	2483524.20	361961.40	19.67
18	GPOB_18	2483493.55	361915.37	17.01
19	GPOB_19	2483498.40	361939.20	16.09
20	GPOB_20	2483527.92	362026.79	14.51
21	GPOB_21	2483520.00	361923.00	14.33
22	GPOB_22	2483511.00	362027.40	14.11
23	GPOB_23	2483501.40	361969.80	13.86
24	GPOB_24	2483489.40	361951.80	13.08
25	GPOB_25	2483518.80	362035.20	12.76
26	GPOB_26	2483506.80	362040.60	11.95
27	GPOB_27	2483496.00	362031.00	11.94
28	GPOB_28	2483515.80	361938.60	11.82
29	GPOB_29	2483488.20	361968.60	10.29
30	GPOB_30	2483524.80	361906.20	10.09
31	GPOB_31	2483518.80	361909.20	10.02
32	GPOB_32	2483525.43	361970.56	9.95
33	GPOB_33	2483528.10	361937.16	9.67
34	GPOB_34	2483524.80	362042.40	9.54
35	GPOB_35	2483499.66	362049.81	9.23
36	GPOB_36	2483515.80	362020.80	9.05
37	GPOB_37	2483505.32	361899.03	9.01

38	GPOB_38	2483520.00	362020.20	8.03
39	GPOB_39	2483503.28	361909.55	7.58
40	GPOB_40	2483515.20	361918.80	7.39
41	GPOB_41	2483498.40	361943.40	7.35
42	GPOB_42	2483515.80	362025.00	7.14
43	GPOB_43	2483505.78	361968.66	7.12
44	GPOB_44	2483502.00	361915.80	6.90
45	GPOB_45	2483505.60	362032.20	6.78
46	GPOB_46	2483499.41	362015.12	6.39
47	GPOB_47	2483505.60	362029.80	6.19
48	GPOB_48	2483493.32	362015.07	6.11
49	GPOB_49	2483496.00	361948.80	6.11
50	GPOB_50	2483488.20	362014.80	5.68
51	GPOB_51	2483492.40	361931.40	5.66
52	GPOB_52	2483506.40	362015.12	5.42
53	GPOB_53	2483527.89	362049.88	5.34
54	GPOB_54	2483496.00	362043.60	5.14
55	GPOB_55	2483513.03	362019.15	5.09
56	GPOB_56	2483509.20	361920.00	4.97
57	GPOB_57	2483508.00	361927.80	4.56
58	GPOB_58	2483491.20	362026.20	4.43
59	GPOB_59	2483489.40	362038.80	4.41
60	GPOB_60	2483492.40	361897.80	4.28
61	GPOB_61	2483518.20	361897.20	4.25
62	GPOB_62	2483518.80	361953.00	4.08
63	GPOB_63	2483513.28	361908.66	3.97
64	GPOB_64	2483508.28	361949.19	3.95
65	GPOB_65	2483526.09	361911.72	3.86
66	GPOB_66	2483511.25	362049.88	3.75
67	GPOB_67	2483528.27	361949.28	3.55
68	GPOB_68	2483518.42	361934.67	3.22
69	GPOB_69	2483524.20	362029.20	3.14
70	GPOB_70	2483513.28	361949.10	3.10
71	GPOB_71	2483503.28	361960.53	3.07

GPO – Towed Array

Contour Map and Target List



CH2M HILL

EM61 MK2 Channel 2 - Towed Array
GPO - Team C
Knox Mobile Home Park
Camp Legeune, North Carolina

Date of Survey: December 8, 2005

CH2M Hill
GPO - Team C - Towed Array
Knox Mobile Home Park
Camp Lejeune, North Carolina

Date of Survey: December 8, 2005

Target Pick Table (EM-61 MK2 - Channel 2)

Targets	Target ID	NAD 83/North Carolina State Planes		Grid Value (mV)
		X (USft)	Y (USft)	
1	GPOC_1	2483492.40	361960.80	256.33
2	GPOC_2	2483500.80	362023.80	230.06
3	GPOC_3	2483499.60	361929.00	150.93
4	GPOC_4	2483497.20	362021.40	123.24
5	GPOC_5	2483526.00	361918.80	114.37
6	GPOC_6	2483508.60	361944.00	107.60
7	GPOC_7	2483492.40	361903.20	106.94
8	GPOC_8	2483528.40	361936.20	96.09
9	GPOC_9	2483509.20	361900.80	93.77
10	GPOC_10	2483519.07	361944.94	71.87
11	GPOC_11	2483504.40	361908.60	71.32
12	GPOC_12	2483513.40	361963.20	70.59
13	GPOC_13	2483488.80	361936.20	64.19
14	GPOC_14	2483497.82	361958.02	54.23
15	GPOC_15	2483527.91	362025.79	52.59
16	GPOC_16	2483493.60	361918.20	46.91
17	GPOC_17	2483501.40	361951.20	42.05
18	GPOC_18	2483518.20	361906.80	39.98
19	GPOC_19	2483498.40	361939.20	27.99
20	GPOC_20	2483526.00	361970.40	27.04
21	GPOC_21	2483490.60	361951.80	25.91
22	GPOC_22	2483509.80	362027.40	25.36
23	GPOC_23	2483495.40	362031.00	24.95
24	GPOC_24	2483519.40	361923.00	23.14
25	GPOC_25	2483504.99	361898.68	20.65
26	GPOC_26	2483524.20	362041.20	20.12
27	GPOC_27	2483522.40	361962.00	19.70
28	GPOC_28	2483501.40	361968.60	19.42
29	GPOC_29	2483509.85	361895.82	17.84
30	GPOC_30	2483488.80	361930.80	17.04
31	GPOC_31	2483515.80	361938.60	17.03
32	GPOC_32	2483488.40	361969.11	16.83
33	GPOC_33	2483515.20	362020.80	15.62
34	GPOC_34	2483505.60	362040.00	14.64
35	GPOC_35	2483518.80	362034.00	14.38
36	GPOC_36	2483509.86	361908.45	14.21
37	GPOC_37	2483524.80	361906.20	12.76

38	GPOC_38	2483514.00	362025.00	11.81
39	GPOC_39	2483500.20	361915.20	11.44
40	GPOC_40	2483499.15	362049.45	11.38
41	GPOC_41	2483504.29	362015.17	11.22
42	GPOC_42	2483490.60	362026.20	10.90
43	GPOC_43	2483505.00	362032.20	10.80
44	GPOC_44	2483490.80	361897.84	10.53
45	GPOC_45	2483527.32	362049.78	9.78
46	GPOC_46	2483527.99	361923.94	9.69
47	GPOC_47	2483488.80	362038.20	9.17
48	GPOC_48	2483508.74	361919.52	8.88
49	GPOC_49	2483495.40	362043.00	8.63
50	GPOC_50	2483511.10	361957.79	8.48
51	GPOC_51	2483528.06	361950.24	7.81
52	GPOC_52	2483521.41	361896.77	7.62
53	GPOC_53	2483512.42	362049.86	7.55
54	GPOC_54	2483509.39	362049.06	7.53
55	GPOC_55	2483497.20	361943.40	7.32
56	GPOC_56	2483514.00	361918.80	7.25
57	GPOC_57	2483494.78	362015.17	7.23
58	GPOC_58	2483512.20	361950.60	7.02
59	GPOC_59	2483489.40	362045.40	6.72
60	GPOC_60	2483489.01	361906.22	6.53
61	GPOC_61	2483508.60	361930.80	6.48
62	GPOC_62	2483524.74	361911.18	6.34
63	GPOC_63	2483501.37	361961.38	5.59
64	GPOC_64	2483520.07	362019.20	5.58
65	GPOC_65	2483494.53	361949.40	5.19
66	GPOC_66	2483516.78	361952.27	5.18
67	GPOC_67	2483488.65	362015.17	5.12
68	GPOC_68	2483504.54	361928.67	4.96
69	GPOC_69	2483523.74	362029.08	4.91
70	GPOC_70	2483488.20	362023.20	4.84
71	GPOC_71	2483496.53	361907.76	4.59
72	GPOC_72	2483489.40	361945.20	4.57
73	GPOC_73	2483526.29	361895.87	4.56
74	GPOC_74	2483514.00	362038.20	4.51
75	GPOC_75	2483511.07	362019.45	4.40
76	GPOC_76	2483519.95	361932.89	3.89
77	GPOC_77	2483506.99	361970.42	3.85
78	GPOC_78	2483520.78	361913.07	3.65
79	GPOC_79	2483501.28	362035.08	3.31
80	GPOC_80	2483506.79	361949.42	3.28

APPENDIX C

Health and Safety Plan

CH2M HILL HEALTH AND SAFETY PLAN

This Health and Safety Plan (HSP) will be kept on the site during field activities and will be reviewed as necessary. The plan will be amended or revised as project activities or conditions change or when supplemental information becomes available. The plan adopts, by reference, the Standards of Practice (SOPs) in the CH2M HILL *Corporate Health and Safety Program*, *Program and Training Manual*, as appropriate. In addition, this plan adopts procedures in the project Work Plan. The Site Safety Coordinator (SSC) is to be familiar with these SOPs and the contents of this plan. CH2M HILL's personnel and subcontractors must sign Attachment 1.

Project Information and Description

PROJECT NO: 330966

CLIENT: Navy

PROJECT/SITE NAME: CLEAN III CTO-109 / MCB Camp Lejeune, Knox Trailer Park Site

SITE ADDRESS: Jacksonville, North Carolina

CH2M HILL PROJECT MANAGER: Tom Roth/ATL (CCI)

CH2M HILL OFFICE: Atlanta

DATE HEALTH AND SAFETY PLAN PREPARED: 8/18/2005

DATE HEALTH AND SAFETY PLAN REVISED: 9/25/2006

DATE(S) OF SITE WORK: November 2005 through May 2006

DATES OF INTRUSIVE INVESTIGATION: November 2006 through January 2007

SITE ACCESS: Refer to attached Figure 1-2. Access to all sites is restricted. 'Main-Side" sites, e.g. Hadnot Point Industrial Area Sites 78, 88, and 94, etc. may be accessed through the Main Gate or the Piney Green Road Gate (contractors entrance) on the east side of the New River, while sites located within the Marine Corps Air Station (MCAS) New River, e.g. Sites 35, 86, 89, and 93 should be accessed via the MCAS New River Gate located west of the New River

SITE SIZE: MCB Camp Lejeune is approximately 236 square miles. Knox Trailer Park site is approximately 133 acres.

SITE TOPOGRAPHY: The site is mostly forested with some mowed areas within the remaining trailer park.

PREVAILING WEATHER: The climate at MCB, Camp Lejeune is characterized by mild winters and hot humid summers. Winters are usually short and mild with occasional and short duration cold periods. Summers are long, hot and humid. Average annual net precipitation is approximately 50 inches. Ambient air temperatures generally range from 33 to 53 degrees Fahrenheit (°F) in the winter months, and 71°F to 88°F during the summer months. Winds are generally south-southwesterly in the summer, and north-northwesterly in the winter (Water and Air Research, 1983). The hurricane season in the immediate area surrounding Camp Lejeune begins on June 1 and continues through November 30. Storms of non-tropical origins such as frontal passages, local thunderstorms, and tornadoes are more frequent and can occur year-round.

SITE DESCRIPTION AND HISTORY: Construction of MCB, Camp Lejeune began in 1941 with the objective of developing the "World's Most Complete Amphibious Training Base". Construction of the Base started at Hadnot Point where the major functions of the Base are centered. During World War II, MCB, Camp Lejeune was used as a training area to prepare Marines for combat. MCB, Camp Lejeune was again used for training during the Korean and Vietnam conflicts, and the Gulf War. MCB, Camp Lejeune is host to five

Marine Corps commands and one Navy command. In addition, MCB Camp Lejeune provides support and training for the following tenet commands: Headquarters Nucleus; Second Marine Expeditionary Force; Second Marine Division; Second Marine Force Service Support Group; Second Marine Surveillance, Reconnaissance, and Intelligence Group; Sixth Marine Expeditionary Brigade; the Naval Hospital; and the Naval Dental Clinic. All of the real estate and infrastructure are owned, operated, and maintained by the host command. The mission of Camp Lejeune is to maintain combat ready units for expeditionary deployment.

MCB, Camp Lejeune is bisected by the New River, which flows in a southeasterly direction and forms a large estuary before entering the Atlantic Ocean. The Atlantic Ocean forms the southeastern boundary of the facility. The western and northwester boundaries are U.S. Route 17 and State Route 24, respectively. The City of Jacksonville, North Carolina is located immediately northwest of MCB, Camp Lejeune.

A majority of the land surrounding the facility is used for agriculture. Estuaries along the coast support commercial fishing and residential resort areas are located adjacent to MCB, Camp Lejeune along the Atlantic Ocean.

The Knox Trailer Park site (refer to attached Figure 1-2) was identified as a former hand grenade training range by the HQ Marine 2002 Range report. Records indicate the potential presence of hand grenades.

DESCRIPTION OF SPECIFIC TASKS TO BE PERFORMED:

- Intrusive investigation of previously-mapped geophysical anomalies in 17 100’x100’ grids totaling 3.9 acres.
- Collection of Direct-Push (DP) soil samples from up to 10 locations;
- Collection of surface water and sediment samples from up to 10 locations;
- Installation of five pairs of shallow and intermediate depth and 10 additional shallow groundwater monitoring wells;
- Collection of groundwater samples from the newly installed monitoring wells at the site; and
- Removal of vegetation followed by performance of a surface MEC clearance; and
- Performance of a geophysical prove out and mapping of the project area.

Site Map

This page is reserved for a Site Map.

(refer to attached Figure 1-2)

Table of Contents

1 Tasks to be Performed Under this Plan

1.1 Description of Tasks

(Reference Field Project Start-up Form)

Refer to project documents (i.e., Work Plan) for detailed task information. A health and safety risk analysis (Section 1.2) has been performed for each task and is incorporated in this plan through task-specific hazard controls and requirements for monitoring and protection. Tasks other than those listed below require an approved amendment or revision to this plan before tasks begin. Refer to Section 8.2 for procedures related to "clean" tasks that do not involve hazardous waste operations and emergency response (Hazwoper).

1.1.1 Hazwoper-Regulated Tasks

- Intrusive investigation
- Drilling
- Geoprobe boring
- Groundwater monitoring
- Removal of vegetation

1.1.2 Non-Hazwoper-Regulated Tasks

Under specific circumstances, the training and medical monitoring requirements of federal or state Hazwoper regulations are not applicable. It must be demonstrated that the tasks can be performed without the possibility of exposure in order to use non-Hazwoper-trained personnel. **Prior approval from the Health and Safety Manager (HSM) is required before these tasks are conducted on regulated hazardous waste sites.**

1.2 Task Hazard Analysis

(Refer to Section 2 for hazard controls)

POTENTIAL HAZARDS	TASKS							
	Removal of vegetation	**Drilling, geoprobe, and well installation & abandonment**	**Groundwater monitoring, aquifer testing**	**Direct Push and Geoprobe**	Manual Intrusive Investigation			
Flying debris/objects	X	X		X				
Noise > 85dBA	X	X		X				
Electrical	X	X	X	X				
Suspended loads		X		X				
Buried utilities, drums, tanks		X		X	X			
Slip, trip, fall	X	X	X	X	X			
Back injury	X	X	X	X	X			
Confined space entry								
Trenches / excavations					X			
Visible lightning	X	X	X	X	X			
Vehicle traffic	X			X				
Elevated work areas/falls				X				
Fires		X						
Entanglement	X	X		X				
Drilling		X		X				
Heavy equipment		X		X				
Working near water								
Working from boat								
IDW Drum Sampling								

2 Hazard Controls

This section provides safe work practices and control measures used to reduce or eliminate potential hazards. These practices and controls are to be implemented by the party in control of either the site or the particular hazard. CH2M HILL employees and subcontractors must remain aware of the hazards affecting them regardless of who is responsible for controlling the hazards. CH2M HILL employees and subcontractors who do not understand any of these provisions should contact the SSC for clarification.

In addition to the controls specified in this section, Project-Activity Self-Assessment Checklists are contained in Attachment 6. These checklists are to be used to assess the adequacy of CH2M HILL and subcontractor site-specific safety requirements. The objective of the self-assessment process is to identify gaps in project safety performance, and prompt for corrective actions in addressing these gaps. Self-assessment checklists should be completed early in the project, when tasks or conditions change, or when otherwise specified by the HSM. The self-assessment checklists, including documented corrective actions, should be made part of the permanent project records, and be promptly submitted to the HSM.

Project-specific frequency for completing self-assessments: Bi-weekly or at the beginning of each project phase.

2.1 Project-Specific Hazards

2.1.1 Arsenic

- Do not enter regulated work areas unless training, medical monitoring, and PPE requirements established by the competent person have been met.
- Do not eat, drink, smoke, chew tobacco or gum, or apply cosmetics in regulated areas.
- Avoid skin and eye contact with liquid and particulate arsenic or arsenic trichloride.
- Arsenic is considered a “Confirmed Human Carcinogen.”
- Arsenic particulates (inorganic metal dust) are odorless. Vapor and gaseous odor varies depending upon specific organic arsenic compound.
- Respiratory protection and other exposure controls selection shall be based on the most recent exposure monitoring results obtained from the competent person.

2.1.2 Benzene

- Do not enter regulated work areas unless training, medical monitoring, and PPE requirements established by the competent person have been met.
- Do not eat, drink, smoke, chew tobacco or gum, or apply cosmetics in regulated areas.
- Skin absorption is a potential route of benzene exposure.
- Benzene is considered a “Confirmed Human Carcinogen.”
- A Short Term Exposure Limit (STEL: 15 minutes) exists for this material.
- Benzene has an aromatic odor.
- Respiratory protection and other exposure controls selection shall be based on the most recent exposure monitoring results obtained from the competent person.

2.1.3 Cold Stress

(Reference CH2M HILL SOP HS-211, *Heat and Cold Stress)*

- Be aware of the symptoms of cold-related disorders, and wear proper, layered clothing for the anticipated fieldwork. Appropriate rain gear is a must in cool weather.
- Consider monitoring the work conditions and adjusting the work schedule using guidelines developed by the U.S. Army (wind-chill index) and the National Safety Council (NSC).

- Wind-Chill Index is used to estimate the combined effect of wind and low air temperatures on exposed skin. The wind-chill index does not take into account the body part that is exposed, the level of activity, or the amount or type of clothing worn. For those reasons, it should only be used as a guideline to warn workers when they are in a situation that can cause cold-related illnesses.
- NSC Guidelines for Work and Warm-Up Schedules can be used with the wind-chill index to estimate work and warm-up schedules for fieldwork. The guidelines are not absolute; workers should be monitored for symptoms of cold-related illnesses. If symptoms are not observed, the work duration can be increased.
- Persons who experience initial signs of immersion foot, frostbite, hypothermia should consult the SSC/DSC to avoid progression of cold-related illness.
- Observe one another for initial signs of cold-related disorders.
- Obtain and review weather forecast – be aware of predicted weather systems along with sudden drops in temperature, increase in winds, and precipitation.

2.1.4 Heat Stress

(Reference CH2M HILL SOP HS-211 *Heat and Cold Stress*)

- Drink 16 ounces of water before beginning work. Disposable cups and water maintained at 50^{o}F to 60^{o}F should be available. Under severe conditions, drink 1 to 2 cups every 20 minutes, for a total of 1 to 2 gallons per day. Do not use alcohol in place of water or other nonalcoholic fluids. Decrease your intake of coffee and caffeinated soft drinks during working hours.
- Acclimate yourself by slowly increasing workloads (e.g., do not begin with extremely demanding activities).
- Use cooling devices, such as cooling vests, to aid natural body ventilation. These devices add weight, so their use should be balanced against efficiency.
- Use mobile showers or hose-down facilities to reduce body temperature and cool protective clothing.
- Conduct field activities in the early morning or evening and rotate shifts of workers, if possible.
- Avoid direct sun whenever possible, which can decrease physical efficiency and increase the probability of heat stress. Take regular breaks in a cool, shaded area. Use a wide-brim hat or an umbrella when working under direct sun for extended periods.
- Provide adequate shelter/shade to protect personnel against radiant heat (sun, flames, hot metal).
- Maintain good hygiene standards by frequently changing clothing and showering.
- Observe one another for signs of heat stress. Persons who experience signs of heat syncope, heat rash, or heat cramps should consult the SSC/DSC to avoid progression of heat-related illness.

2.1.5 Drilling

(Reference CH2M HILL SOP HS-204, *Drilling*)

- Only authorized personnel are permitted to operate drill rigs.
- Stay clear of areas surrounding drill rigs during every startup.
- Stay clear of the rotating augers and other rotating components of drill rigs.
- Stay as clear as possible of all hoisting operations. Loads shall not be hoisted overhead of personnel.
- Do not wear loose-fitting clothing or other items such as rings or watches that could get caught in moving parts. Long hair should have it restrained.
- If equipment becomes electrically energized, personnel shall be instructed not to touch any part of the equipment or attempt to touch any person who may be in contact with the electrical current. The utility company or appropriate party shall be contacted to have line de-energized prior to approaching the equipment.
- Smoking around drilling operations is prohibited.

2.1.6 Earthmoving Equipment

(Reference CH2M HILL SOP HS-306, *Earthmoving Equipment*)

- Only authorized personnel are permitted to operate earthmoving equipment.
- Maintain safe distance from operating equipment and stay alert of equipment movement. Avoid positioning between fixed objects and operating equipment and equipment pinch points, remain outside of the equipment swing and turning radius. Pay attention to backup alarms, but not rely on them for protection. Never turn your back on operating equipment.
- Approach operating equipment only after receiving the operator's attention. The operator shall acknowledge your presence and stop movement of the equipment. Caution shall be used when standing next to idle equipment; when equipment is placed in gear it can lurch forward or backward. Never approach operating equipment from the side or rear where the operator's vision is compromised.
- When required to work in proximity to operating equipment, wear high-visibility vests to increase visibility to equipment operators. For work performed after daylight hours, vests shall be made of reflective material or include a reflective stripe or panel.
- Do not ride on earthmoving equipment unless it is specifically designed to accommodate passengers. Only ride in seats that are provided for transportation and that are equipped with seat belts.
- Stay as clear as possible of all hoisting operations. Loads shall not be hoisted overhead of personnel.
- Earthmoving equipment shall not be used to lift or lower personnel.
- If equipment becomes electrically energized, personnel shall be instructed not to touch any part of the equipment or attempt to touch any person who may be in contact with the electrical current. The utility company or appropriate party shall be contacted to have line de-energized prior to approaching the equipment.

2.1.7 IDW Drum Sampling

Personnel are permitted to handle and/or sample drums containing investigation-derived waste (IDW) only; handling or sampling other drums requires a plan revision or amendment approved by the CH2M HILL HSM. The following control measures will be taken when sampling drums containing IDW:

- Minimize transportation of drums.
- Sample only labeled drums or drums known to contain IDW.
- Use caution when sampling bulging or swollen drums. Relieve pressure slowly.
- If drums contain, or potentially contain, flammable materials, use non-sparking tools to open.
- Picks, chisels, and firearms may not be used to open drums.
- Reseal bung holes or plugs whenever possible.
- Avoid mixing incompatible drum contents.
- Sample drums without leaning over the drum opening.
- Transfer the content of drums using a method that minimizes contact with material.
- PPE and air monitoring requirements specified in Sections 4 and 5 must address IDW drum sampling.
- Spill-containment procedures specified in Section 7 must be appropriate for the material to be handled.

2.2 General Hazards

2.2.1 General Practices and Housekeeping

(Reference CH2M HILL SOP HS-209, *General Practices*)

- Site work should be performed during daylight hours whenever possible. Work conducted during hours of darkness require enough illumination intensity to read a newspaper without difficulty.
- Good housekeeping must be maintained at all times in all project work areas.
- Common paths of travel should be established and kept free from the accumulation of materials.
- Keep access to aisles, exits, ladders, stairways, scaffolding, and emergency equipment free from obstructions.

- Provide slip-resistant surfaces, ropes, and/or other devices to be used.
- Specific areas should be designated for the proper storage of materials.
- Tools, equipment, materials, and supplies shall be stored in an orderly manner.
- As work progresses, scrap and unessential materials must be neatly stored or removed from the work area.
- Containers should be provided for collecting trash and other debris and shall be removed at regular intervals.
- All spills shall be quickly cleaned up. Oil and grease shall be cleaned from walking and working surfaces.

2.2.2 Hazard Communication

(Reference CH2M HILL SOP HS-05, *Hazard Communication)*

The SSC is to perform the following:

- Complete an inventory of chemicals brought on site by CH2M HILL using Attachment 2.
- Confirm that an inventory of chemicals brought on site by CH2M HILL subcontractors is available.
- Request or confirm locations of Material Safety Data Sheets (MSDSs) from the client, contractors, and subcontractors for chemicals to which CH2M HILL employees potentially are exposed.
- Before or as the chemicals arrive on site, obtain an MSDS for each hazardous chemical.
- Label chemical containers with the identity of the chemical and with hazard warnings, and store properly.
- Give employees required chemical-specific HAZCOM training using Attachment 3.
- Store all materials properly, giving consideration to compatibility, quantity limits, secondary containment, fire prevention, and environmental conditions.

2.2.3 Shipping and Transportation of Chemical Products

(Reference CH2M HILL's *Procedures for Shipping and Transporting Dangerous Goods)*

Chemicals brought to the site might be defined as hazardous materials by the U.S. Department of Transportation (DOT). All staff who ship the materials or transport them by road must receive CH2M HILL training in shipping dangerous goods. All hazardous materials that are shipped (e.g., via Federal Express) or are transported by road must be properly identified, labeled, packed, and documented by trained staff. Contact the HSM or the Equipment Coordinator for additional information.

2.2.4 Lifting

(Reference CH2M HILL SOP HS-112, *Lifting*)

- Proper lifting techniques must be used when lifting any object.
  - Plan storage and staging to minimize lifting or carrying distances.
  - Split heavy loads into smaller loads.
  - Use mechanical lifting aids whenever possible.
  - Have someone assist with the lift -- especially for heavy or awkward loads.
  - Make sure the path of travel is clear prior to the lift.

2.2.5 Fire Prevention

(Reference CH2M HILL SOP HS-208 *Fire Prevention*)

- Fire extinguishers shall be provided so that the travel distance from any work area to the nearest extinguisher is less than 100 feet. When 5 gallons or more of a flammable or combustible liquid is being used, an extinguisher must be within 50 feet. Extinguishers must:
  - be maintained in a fully charged and operable condition,
  - be visually inspected each month, and
  - undergo a maintenance check each year.
- The area in front of extinguishers must be kept clear.
- Post "Exit" signs over exiting doors, and post "Fire Extinguisher" signs over extinguisher locations.

- Combustible materials stored outside should be at least 10 feet from any building.
- Solvent waste and oily rags must be kept in a fire resistant, covered container until removed from the site.
- Flammable/combustible liquids must be kept in approved containers, and must be stored in an approved storage cabinet.

2.2.6 Electrical

(Reference CH2M HILL SOP HS-206 *Electrical*)

- Only qualified personnel are permitted to work on unprotected energized electrical systems.
- Only authorized personnel are permitted to enter high-voltage areas.
- Do not tamper with electrical wiring and equipment unless qualified to do so. All electrical wiring and equipment must be considered energized until lockout/tagout procedures are implemented.
- Inspect electrical equipment, power tools, and extension cords for damage prior to use. Do not use defective electrical equipment, remove from service.
- All temporary wiring, including extension cords and electrical power tools, must have ground fault circuit interrupters (GFCIs) installed.
- Extension cords must be:
  - equipped with third-wire grounding.
  - covered, elevated, or protected from damage when passing through work areas.
  - protected from pinching if routed through doorways.
  - not fastened with staples, hung from nails, or suspended with wire.
- Electrical power tools and equipment must be effectively grounded or double-insulated UL approved.
- Operate and maintain electric power tools and equipment according to manufacturers' instructions.
- Maintain safe clearance distances between overhead power lines and any electrical conducting material unless the power lines have been de-energized and grounded, or where insulating barriers have been installed to prevent physical contact. Maintain at least 10 feet from overhead power lines for voltages of 50 kV or less, and 10 feet plus ½ inch for every 1 kV over 50 kV.
- Temporary lights shall not be suspended by their electric cord unless designed for suspension. Lights shall be protected from accidental contact or breakage.
- Protect all electrical equipment, tools, switches, and outlets from environmental elements.

2.2.7 Stairways and Ladders

(Reference CH2M HILL SOP HS-214, *Stairways and Ladders*)

- Stairway or ladder is generally required when a break in elevation of 19 inches or greater exists.
- Personnel should avoid using both hands to carry objects while on stairways; if unavoidable, use extra precautions.
- Personnel must not use pan and skeleton metal stairs until permanent or temporary treads and landings are provided the full width and depth of each step and landing.
- Ladders must be inspected by a competent person for visible defects prior to each day’s use. Defective ladders must be tagged and removed from service.
- Ladders must be used only for the purpose for which they were designed and shall not be loaded beyond their rated capacity.
- Only one person at a time shall climb on or work from an individual ladder.
- User must face the ladder when climbing; keep belt buckle between side rails
- Ladders shall not be moved, shifted, or extended while in use.
- User must use both hands to climb; use rope to raise and lower equipment and materials
- Straight and extension ladders must be tied off to prevent displacement
- Ladders that may be displaced by work activities or traffic must be secured or barricaded
- Portable ladders must extend at least 3 feet above landing surface
- Straight and extension ladders must be positioned at such an angle that the ladder base to the wall is one-fourth of the working length of the ladder

- Stepladders are to be used in the fully opened and locked position
- Users are not to stand on the top two steps of a stepladder; nor are users to sit on top or straddle a stepladder
- Fixed ladders $\geq$ 24 feet in height must be provided with fall protection devices.
- Fall protection should be considered when working from extension, straight, or fixed ladders greater than six feet from lower levels and both hands are needed to perform the work, or when reaching or working outside of the plane of ladder side rails.

2.2.8 Heat Stress

(Reference CH2M HILL SOP HS-211, *Heat and Cold Stress*)

- Drink 16 ounces of water before beginning work. Disposable cups and water maintained at 50°F to 60°F should be available. Under severe conditions, drink 1 to 2 cups every 20 minutes, for a total of 1 to 2 gallons per day. Do not use alcohol in place of water or other nonalcoholic fluids. Decrease your intake of coffee and caffeinated soft drinks during working hours.
- Acclimate yourself by slowly increasing workloads (e.g., do not begin with extremely demanding activities).
- Use cooling devices, such as cooling vests, to aid natural body ventilation. These devices add weight, so their use should be balanced against efficiency.
- Use mobile showers or hose-down facilities to reduce body temperature and cool protective clothing.
- Conduct field activities in the early morning or evening and rotate shifts of workers, if possible.
- Avoid direct sun whenever possible, which can decrease physical efficiency and increase the probability of heat stress. Take regular breaks in a cool, shaded area. Use a wide-brim hat or an umbrella when working under direct sun for extended periods.
- Provide adequate shelter/shade to protect personnel against radiant heat (sun, flames, hot metal).
- Maintain good hygiene standards by frequently changing clothing and showering.
- Observe one another for signs of heat stress. Persons who experience signs of heat syncope, heat rash, or heat cramps should consult the SSC/DSC to avoid progression of heat-related illness.

SYMPTOMS AND TREATMENT OF HEAT STRESS					
	Heat Syncope	Heat Rash	Heat Cramps	Heat Exhaustion	Heat Stroke
Signs and Symptoms	Sluggishness or fainting while standing erect or immobile in heat.	Profuse tiny raised red blister-like vesicles on affected areas, along with prickling sensations during heat exposure.	Painful spasms in muscles used during work (arms, legs, or abdomen); onset during or after work hours.	Fatigue, nausea, headache, giddiness; skin clammy and moist; complexion pale, muddy, or flushed; may faint on standing; rapid thready pulse and low blood pressure; oral temperature normal or low	Red, hot, dry skin; dizziness; confusion; rapid breathing and pulse; high oral temperature.
Treatment	Remove to cooler area. Rest lying down. Increase fluid intake. Recovery usually is prompt and complete.	Use mild drying lotions and powders, and keep skin clean for drying skin and preventing infection.	Remove to cooler area. Rest lying down. Increase fluid intake.	Remove to cooler area. Rest lying down, with head in low position. Administer fluids by mouth. Seek medical attention.	Cool rapidly by soaking in cool–but not cold–water. Call ambulance, and get medical attention immediately!

Monitoring Heat Stress

These procedures should be considered when the ambient air temperature exceeds 70°F, the relative humidity is high (>50 percent), or when workers exhibit symptoms of heat stress.

The heart rate (HR) should be measured by the radial pulse for 30 seconds, as early as possible in the resting period. The HR at the beginning of the rest period should not exceed 100 beats/minute, or 20 beats/minute above resting pulse. If the HR is higher, the next work period should be shortened by 33 percent, while the length of the rest period stays the same. If the pulse rate still exceeds 100 beats/minute at the beginning of the next rest period, the work cycle should be further shortened by 33 percent. The procedure is continued until the rate is maintained below 100 beats/minute, or 20 beats/minute above resting pulse.

2.2.9 Cold Stress

(Reference CH2M HILL SOP HS-211, *Heat and Cold Stress*)

- Be aware of the symptoms of cold-related disorders, and wear proper, layered clothing for the anticipated fieldwork. Appropriate rain gear is a must in cool weather.
- Consider monitoring the work conditions and adjusting the work schedule using guidelines developed by the U.S. Army (wind-chill index) and the National Safety Council (NSC).
- Wind-Chill Index is used to estimate the combined effect of wind and low air temperatures on exposed skin. The wind-chill index does not take into account the body part that is exposed, the level of activity, or the amount or type of clothing worn. For those reasons, it should only be used as a guideline to warn workers when they are in a situation that can cause cold-related illnesses.
- NSC Guidelines for Work and Warm-Up Schedules can be used with the wind-chill index to estimate work and warm-up schedules for fieldwork. The guidelines are not absolute; workers should be monitored for symptoms of cold-related illnesses. If symptoms are not observed, the work duration can be increased.
- Persons who experience initial signs of immersion foot, frostbite, hypothermia should consult the SSC/DSC to avoid progression of cold-related illness.
- Observe one another for initial signs of cold-related disorders.
- Obtain and review weather forecast – be aware of predicted weather systems along with sudden drops in temperature, increase in winds, and precipitation.

SYMPTOMS AND TREATMENT OF COLD STRESS			
	Immersion (Trench) Foot	**Frostbite**	**Hypothermia**
Signs and Symptoms	Feet discolored and painful; infection and swelling present.	Blanched, white, waxy skin, but tissue resilient; tissue cold and pale.	Shivering, apathy, sleepiness; rapid drop in body temperature; glassy stare; slow pulse; slow respiration.
Treatment	Seek medical treatment immediately.	Remove victim to a warm place. Re-warm area quickly in warm–but **not** hot–water. Have victim drink warm fluids, but **not** coffee or alcohol. Do not break blisters. Elevate the injured area, and get medical attention.	Remove victim to a warm place. Have victim drink warm fluids, but **not** coffee or alcohol. Get medical attention.

2.2.10 Compressed Gas Cylinders

- Valve caps must be in place when cylinders are transported, moved, or stored.
- Cylinder valves must be closed when cylinders are not being used and when cylinders are being moved.
- Cylinders must be secured in an upright position at all times.
- Cylinders must be shielded from welding and cutting operations and positioned to avoid being struck or knocked over; contacting electrical circuits; or exposed to extreme heat sources.
- Cylinders must be secured on a cradle, basket, or pallet when hoisted; they may not be hoisted by choker slings.

2.2.11 Procedures for Locating Buried Utilities

Local Utility Mark-Out Service

Name: To be determined
Phone:

- Where available, obtain utility diagrams for the facility.
- Review locations of sanitary and storm sewers, electrical conduits, water supply lines, natural gas lines, and fuel tanks and lines.
- Review proposed locations of intrusive work with facility personnel knowledgeable of locations of utilities. Check locations against information from utility mark-out service.
- Where necessary (e.g., uncertainty about utility locations), excavation or drilling of the upper depth interval should be performed manually
- Monitor for signs of utilities during advancement of intrusive work (e.g., sudden change n advancement of auger or split spoon).
- When the client or other onsite party is responsible for determining the presence and locations of buried utilities, the SSC should confirm that arrangement.

2.2.12 Confined Space Entry

(Reference CH2M HILL SOP HS-203, *Confined Space Entry*)

No confined space entry will be permitted. Confined space entry requires additional health and safety procedures, training, and a permit. If conditions change such that confined-space entry is necessary, contact the HSM to develop the required entry permit.
When planned activities will not include confined-space entry, permit-required confined spaces accessible to CH2M HILL personnel are to be identified before the task begins. The SSC is to confirm that permit spaces are properly posted or that employees are informed of their locations and hazards.

2.3 Biological Hazards and Controls

2.3.1 Snakes

Snakes typically are found in underbrush and tall grassy areas. If you encounter a snake, stay calm and look around; there may be other snakes. Turn around and walk away on the same path you used to approach the area. If a person is bitten by a snake, wash and immobilize the injured area, keeping it lower than the heart if possible. Seek medical attention immediately. **DO NOT** apply ice, cut the wound, or apply a tourniquet. Try to identify the type of snake: note color, size, patterns, and markings.

2.3.2 Poison Ivy and Poison Sumac

Poison ivy, poison oak, and poison sumac typically are found in brush or wooded areas. They are more commonly found in moist areas or along the edges of wooded areas. Become familiar with the identity of these plants. Wear protective clothing that covers exposed skin and clothes. Avoid contact with plants and the outside of protective clothing. If skin contacts a plant, wash the area with soap and water immediately. If the reaction is severe or worsens, seek medical attention.

2.3.3 Ticks

Ticks typically are in wooded areas, bushes, tall grass, and brush. Ticks are black, black and red, or brown and can be up to one-quarter inch in size. Wear tightly woven light-colored clothing with long sleeves and pant legs tucked into boots; spray **only outside** of clothing with permethrin or permanone and spray skin with only DEET; and check yourself frequently for ticks.

If bitten by a tick, grasp it at the point of attachment and carefully remove it. After removing the tick, wash your hands and disinfect and press the bite areas. Save the removed tick. Report the bite to human resources. Look for symptoms of Lyme disease or Rocky Mountain spotted fever (RMSF). Lyme: a rash might appear that looks like a bullseye with a small welt in the center. RMSF: a rash of red spots under the skin 3 to 10 days after the tick bite. In both cases, chills, fever, headache, fatigue, stiff neck, and bone pain may develop. If symptoms appear, seek medical attention.

2.3.4 Bees and Other Stinging Insects

Bee and other stinging insects may be encountered almost anywhere and may present a serious hazard, particularly to people who are allergic. Watch for and avoid nests. Keep exposed skin to a minimum. Carry a kit if you have had allergic reactions in the past, and inform the SSC and/or buddy. If a stinger is present, remove it carefully with tweezers. Wash and disinfect the wound, cover it, and apply ice. Watch for allergic reaction; seek medical attention if a reaction develops.

2.3.5 Bloodborne Pathogens

(Reference CH2M HILL SOP HS-202, *Bloodborne Pathogens*)

Exposure to bloodborne pathogens may occur when rendering first aid or CPR, or when coming into contact with landfill waste or waste streams containing potentially infectious material. Exposure controls and personal protective equipment (PPE) are required as specified in CH2M HILL SOP HS-36, *Bloodborne Pathogens*. Hepatitis B vaccination must be offered before the person participates in a task where exposure is a possibility.

2.3.6 Mosquito Bites

Due to the recent detection of the West Nile Virus in the Southeastern United States it is recommended that **preventative measures** be taken to reduce the probability of being bitten by mosquitoes whenever possible. Mosquitoes are believed to be the primary source for exposure to the West Nile Virus as well as several other types of encephalitis . The following guidelines should be followed to reduce the risk of these concerns for working in areas where mosquitoes are prevalent.

- Stay indoors at dawn, dusk, and in the early evening.
- Wear long-sleeved shirts and long pants whenever you are outdoors.
- Spray clothing with repellents containing permethrin or DEET since mosquitoes may bite through thin clothing.
- Apply insect repellent sparingly to exposed skin. An effective repellent will contain 35% DEET (N,N-diethyl-meta-toluamide). DEET in high concentrations (greater than 35%) provides no additional protection.
- Repellents may irritate the eyes and mouth, so avoid applying repellent to the hands.
- Whenever you use an insecticide or insect repellent, be sure to read and follow the manufacturer's DIRECTIONS FOR USE, as printed on the product.

Note: Vitamin B and "ultrasonic" devices are NOT effective in preventing mosquito bites.

Symptoms of Exposure to the West Nile Virus

Most infections are mild, and symptoms include fever, headache, and body aches, occasionally with skin rash and swollen lymph glands. More severe infection may be marked by headache, high fever, neck stiffness, stupor, disorientation, coma, tremors, convulsions, muscle weakness, paralysis, and, rarely, death.

The West Nile Virus incubation period is from 3-15 days.

If you have any questions or to report any suspicious symptoms, contact the project Health and Safety Manager.

2.3.7 Fire Ant Bites

Fire ants are common in the southern U.S. These insects typically build mounds on the land surface that are usually easy to identify. Avoid disturbing these mounds. A bite from a fire ant can be painful but rarely is life threatening. However, it is possible that the bite could cause an allergic reaction. If bitten, check for symptoms of an allergic reaction such as weakness, nausea, vomiting, dizziness, or shortness of breath. If symptoms appear, seek medical attention

2.4 Radiological Hazards and Controls

Refer to CH2M HILL's *Corporate Health and Safety Program, Program and Training Manual,* and *Corporate Health and Safety Program, Radiation Protection Program Manual*, for standards of practice in contaminated areas.

Hazards	Controls
None Known	None Required

2.5 UXO/MEC

Procedures for the intrusive investigation of geophysical anomalies are provided in the USAE SOPs (see Appendix D of the MEC Intrusive Investigation Work Plan).

MEC Avoidance Procedures. MEC avoidance operations will be required during vegetation removal, sampling and drilling operations. Avoidance operations will consist of a team composed of two UXO Technicians. This team will consist of a UXO Technician III and a UXO Technician II. The UXO Team will not destroy any MEC encountered. All MEC contacts and suspected MEC anomalies will be reported to the site manager who will in turn notify in accordance with contractual requirements.

Access routes to sampling locations. Prior to sampling or well drilling crews on site, the UXO Technicians will conduct a reconnaissance of the sampling area. The reconnaissance will include locating the designated sampling or drilling location(s) and insuring that they are free of anomalies. If anomalies are detected the point will be relocated as directed. Once the designed point has been cleared, an access route for the sampling crew's vehicles and equipment will be cleared. The access route, at a minimum will be twice the width of the widest vehicle and the boundaries will be clearly marked to prevent personnel from straying into non cleared areas. If surface MEC is encountered, the UXO Team will mark and report the item and divert the approach path around the MEC. A magnetometer will be used to ensure there are no subsurface MEC with the approach path. If a subsurface magnetic anomaly is encountered, it will be assumed to be a possible MEC and the path diverted to avoid it.

Vegetation removal will be performed under the direction of UXO Technicians; all activities will be conducted after a visual and/or electronic (magnetic) sweep of the area by the UXO Technicians. Mechanical and manual vegetation removal teams will include one or more UXO Technicians using appropriate geophysical instruments and observations to avoid MEC.

Soil Sampling and Well Drilling Sites. The UXO Technicians will clear a work site for soil samples and well drilling and clearly mark the boundaries. The area will be large enough to accommodate the drilling equipment and provide a work area for the crews. As a minimum, the cleared area will be a square, with a side dimension equal to twice the length of the largest vehicle or piece of equipment for use on site. If a pre-selected area indicates magnetic anomalies, a new sampling / drill site will be chosen.

Borehole Sampling. If surface samples are required they will be obtained prior to the start of boring. The borehole procedures will be completed using a hand auger, power auger or direct push technology (DPT) equipment. The UXO Technicians will check the borehole with a down hole magnetometer a minimum of every one foot, to the deepest sampling depth or a maximum of 4 feet (based on MK II Hand Grenade) to ensure that smaller items of MEC, undetectable from the surface will be detected.

Monitoring Well installation. Prior to drilling equipment being moved to the proposed site, the UXO Technicians will have checked the designed site, using a magnetometer or equivalent, to assure that the well location is anomaly free to a depth of one foot. If surface samples are required they will be obtained prior to the start of drilling. To complete the subsurface magnetometer checks, one of two methods may be used.

- Monitoring at 1 foot increments, during the actual well drilling operation. This will require the withdrawal of the drill rod or augers from the well and moving the drill rig a minimum of 20 feet away from the well location to prevent the rig from influencing the magnetometer , or
- Installing an offset monitoring hole within two feet of the well location. This monitoring hole can be installed by the UXO Technician with a hand or power auger, and monitored at one foot increments to the desired well depth or a maximum of 4 feet.

Removal of MEC-related scrap & non-MEC related scrap. For the purpose of disposal, scrap material shall be segregated and defined as Groups 1a, Group 1b, or Group 2.

Group 1 includes property that previously contained explosives or that does not contain items of a dangerous nature and can be certified inert and or free of explosives or other dangerous materials.

Group 1a includes firing range expended small arms cartridges and inert metals gleaned from range cleanup.

Group 1b includes any certifiable material or items not meeting the criteria in 1a above. A determination shall be made as to whether the material or item requires demilitarization. Damage sustained does not necessarily constitute demilitarization.

Group 2 includes inherently dangerous items that may potentially contain MEC and cannot be certified as inert.

MPPEH Certification and Verification

SUXOS will confirm that non-MEC scrap and MEC scrap is properly inspected in accordance with DOD standards. Only UXO Technicians will perform these inspections. The SUXOS will certify that the scrap metal is free of explosive hazards and the UXOSO will verify that information via DD Form 1348-1A.

As part of the transfer of MD or range related debris for final disposition, the following certification / verification will be entered on each DD 1348-1A will be signed by the SUXOS and the UXOSO.

"This certifies that the material listed has been 100 percent properly inspected and to the best of our knowledge and belief, are free of explosive hazards, engine fluids, illuminating dials, and other visible liquid HTWR materials."

Maintaining the Chain of Custody and Final Disposition

All MPPEH that is to be inspected and certified / verified will be kept under control to ensure no foreign material is inadvertently added. This may require locking rings for drums, fenced in area or containers that can be secured. Labeling as to content and hazard (if appropriate) must be accomplished. Final disposition will be in accordance with contractual requirements.

CONTACT WITH MEC IS PROHIBITED

Grenades

- Do not attempt to re-install safety pins on a dud fired grenade;
- Do not attempt to withdraw impinged firing pins from the fuze of a dud fired grenade;
- Do not dispose of grenades by functioning them as designed;

Chemical hazards associated with MEC include toxicity. Toxicity may occur following inhalation of chemical vapors that could potentially be released from soil and ingestion or direct contact with soil and/or ground water that could potentially contain hazardous substances. Therefore, ensure basic sanitation (washing of hands), eating, smoking, etc., are prohibited in the Area.

Explosive Residues such as 2,4,6-trinitrotoluene (TNT) 1,3-dinitrobenzene (DNB) and 1,3,5-trinitrobenzene (TNB) are synthetic substances used in explosives. They dissolve in certain liquids. They have no odor or taste. Could affect the nervous system and liver if swallowed or gets on the skin. Exposure to residues can occur through eating, drinking, touching, or inhaling contaminated soil, water, food or air. Therefore ensure proper PPE use and basic sanitation (washing of hands), eating and smoking are prohibited in the work area.

Dioxins/Furans - polychlorinated dibenzo-para-dioxins (PCDDs) and polychlorinated dibensofurans (PCDFs) are solid at room temperature and have a rather low volatility. Route of exposure is through ingestion. Therefore, ensure proper PPE use and basic sanitation (washing of hands); eating and smoking are prohibited in the work area.

2.5 Contaminants of Concern

(Refer to Project Files for more detailed contaminant information)

Contaminant	Location and Maximum[a] Concentration (ppm)	Exposure Limit[b]	IDLH[c]	Symptoms and Effects of Exposure	PIP[d] (eV)
Arsenic	GW: SB: SS:	0.01 mg/m^3	5 Ca	Ulceration of nasal septum, respiratory irritation, dermatitis, gastrointestinal disturbances, peripheral neuropathy, hyperpigmentation	NA
Benzene	GW: SB: SS:	1 ppm	500 Ca	Eye, nose, skin, and respiratory irritation; headache; nausea; dermatitis; fatigue; giddiness; staggered gait; bone marrow depression	9.24
PCBs (Limits as Aroclor 1254)	GW: SB: SS:	0.5 mg/m^3	5 Ca	Eye and skin irritation, acne-form dermatitis, liver damage, reproductive effects	UK
PNAs (Limits as Coal Tar Pitch)	GW: SB: SS:	02 mg/m^3	80 Ca	Dermatitis and bronchitis	UK
2,4,6-trinitrotoluene (TNT) and	GW: SB: SS:	1.5 mg/m^3	500 mg/m^3	Irritation skin, mucous membrane; liver damage, jaundice; cyanosis; sneezing; cough, sore throat; peripheral neuropathy, muscle pain; kidney damage; cataract; sensitization dermatitis; leukocytosis (increased blood leukocytes); anemia; cardiac irregularities	UK
1,3-dinitrobenzene (DNB)	GW: SB: SS:	1 mg/m^3	50 mg/m^3	Anoxia, cyanosis; visual disturbance, central scotomas; bad taste, burning mouth, dry throat, thirst; yellowing hair, eyes, skin; anemia; liver damage	UK

Footnotes:

[a] Specify sample-designation and media: SB (Soil Boring), A (Air), D (Drums), GW (Groundwater), L (Lagoon), TK (Tank), S (Surface Soil), SL (Sludge), SW (Surface Water).

[b] Appropriate value of PEL, REL, or TLV listed.

[c] IDLH = immediately dangerous to life and health (units are the same as specified "Exposure Limit" units for that contaminant); NL = No limit found in reference materials; CA = Potential occupational carcinogen.

[d] PIP = photoionization potential; NA = Not applicable; UK = Unknown.

2.6 Potential Routes of Exposure

Dermal: Contact with contaminated media. This route of exposure is minimized through proper use of PPE, as specified in Section 4.	**Inhalation:** Vapors and contaminated particulates. This route of exposure is minimized through proper respiratory protection and monitoring, as specified in Sections 4 and 5, respectively.	**Other:** Inadvertent ingestion of contaminated media. This route should not present a concern if good hygiene practices are followed (e.g., wash hands and face before drinking or smoking).

3 Project Organization and Personnel

3.1 CH2M HILL Employee Medical Surveillance and Training

(Reference CH2M HILL SOPs HS-113, *Medical Surveillance,* and HS-02, *Health and Safety Training)*

The employees listed below are enrolled in the CH2M HILL Comprehensive Health and Safety Program and meet state and federal hazardous waste operations requirements for 40-hour initial training, 3-day on-the-job experience, and 8-hour annual refresher training. Employees designated "SSC" have completed a 12-hour site safety coordinator course, and have documented requisite field experience. An SSC with a level designation (D, C, B) equal to or greater than the level of protection being used must be present during all tasks performed in exclusion or decontamination zones. Employees designated "FA-CPR" are currently certified by the American Red Cross, or equivalent, in first aid and CPR. At least one FA-CPR designated employee must be present during all tasks performed in exclusion or decontamination zones. The employees listed below are currently active in a medical surveillance program that meets state and federal regulatory requirements for hazardous waste operations. Certain tasks (e.g., confined-space entry) and contaminants (e.g., lead) may require additional training and medical monitoring.

Pregnant employees are to be informed of and are to follow the procedures in CH2M HILL's SOP HS-04, *Reproduction Protection,* including obtaining a physician's statement of the employee's ability to perform hazardous activities before being assigned fieldwork.

Employee Name	Office	Responsibility	SSC/FA-CPR
Richard Deleon	SAN	Field Team Leader	Level D SSC: FA-CPR

3.2 Field Team Chain of Command and Communication Procedures

3.2.1 Client

Client Contact
Daniel Hood, PE
NAVFAC Atlantic
Code: OPCEV
6506 Hampton Blvd
Norfolk, Virginia 23508-1278
757-322-4630
757-322-4805 fax
daniel.r.hood@navy.mil

Base Contact
Robert Lowder
Camp Lejeune - EMD
Building 12
Marine Corps Base
Camp Lejeune, NC 28542-0004
(910) 451-9607
(910) 451-5997
robert.a.lowder@usmc.mil

3.2.2 CH2M HILL

Project Manager: Tom Roth/ATL
Health and Safety Manager: Michael Goldman/ATL for General and Dan Young./NVR for MEC
Field Team Leader: Rick Deleon/SAN
Site Safety Coordinator: Rick Deleon/SAN
UXO Safety Officer (UXOSO): TBD

The SSC is responsible for contacting the Field Team Leader and Project Manager. In general, the Project Manager will contact the client. The Health and Safety Manager should be contacted as appropriate.

UXO TECHNICIAN III

The UXO Technician III for this project will report directly to the Project Manager on issues pertaining to the operations at the Knox Trailer Park project site. The UXO Technician III will have the following safety and health related responsibilities:

- Reports directly to the CH2M HILL Project Manager;
- Managing the funding, manpower and equipment necessary to safely conduct site operations;
- Reviewing and becoming familiar with the site Work Plan (WP) and SSHP;
- Provide copies of the WP and SSHP to site and subcontract personnel;
- Review the scope of work (SOW) and ensure that the required safety and health elements are addressed in the SSHP and/or WP;
- Coordinating the assignment of personnel and ensuring that the personnel and equipment provided meet the requirements of the WP and SSHP;
- Ensuring implementation of project quality, safety and health procedures;
- Early detection and identification of potential problem areas, including safety & health matters, and instituting corrective measures;
- Directly interfacing with the Project manager and advising him of safety and health matters related to conduct of the site operations.
- Acts as the On-Scene-Incident-Commander (OSIC) in the event of an MEC emergency, notifying and coordinating with off site emergency and medical response agencies.

UXO SITE SAFETY OFFICER

The UXO Site Safety Officer (UXOSO) for this project reports directly to the Project Manager and oversees all UXO safety and heath aspects for this site. For this project the UXO Technician III will assume the duties of the UXOSO. He/she will coordinate all daily activities with the Project Manager. The UXOSO will have the following responsibilities;

- Has STOP WORK authority for UXO safety and heath reasons;
- Implement and enforce the SSHP, and report safety violations to the Project Manager and other appropriate personnel;
- Establishing work zones and controlling access to these zones;
- Conduct daily UXO Safety Briefings;
- Implement and document the Site Specific Hazard Information Training Program;
- Consulting with the SUXOS as necessary;
- Assisting in the continued development of this Avoidance Plan, and the SSHP and other safety and health procedures, as applicable;
- Investigate and report accidents/incidents and ‘near misses;”
- Conduct visitor orientation;
- Enforce the “buddy” system;
- Restrict site personnel from site activities if they exhibit systems of alcohol or drug use or illness, and continually monitor site personnel for signs of environmental exposure or physical stress;
- Maintain the site safety and monitoring logs;

- Maintains an alternate line of communication with the Project Manager.

UXO TECHNICIANS

All UXO Technicians are required to comply with the provisions of this Avoidance Plan, the SSHP, the WP and all applicable Federal, State and local regulations. They will report to the UXO Technician III.

3.2.3 CH2M HILL Subcontractors

(Reference CH2M HILL SOP HS-215, *Subcontractor, Contractor, and Owner*)

Subcontractor: To be determined
Subcontractor Contact Name:
Telephone:

The subcontractors listed above are covered by this HSP and must be provided a copy of this plan. However, this plan does not address hazards associated with the tasks and equipment that the subcontractor has expertise in (e.g., drilling, excavation work, electrical). Subcontractors are responsible for the health and safety procedures specific to their work, and are required to submit these procedures to CH2M HILL for review before the start of field work. Subcontractors must comply with the established health and safety plan(s). The CH2M HILL SSC should verify that subcontractor employee training, medical clearance, and fit test records are current and must monitor and enforce compliance with the established plan(s). CH2M HILL's oversight does not relieve subcontractors of their responsibility for effective implementation and compliance with the established plan(s).

CH2M HILL should continuously endeavor to observe subcontractors' safety performance. This endeavor should be reasonable, and include observing for hazards or unsafe practices that are both readily observable and occur in common work areas. CH2M HILL is not responsible for exhaustive observation for hazards and unsafe practices. In addition to this level of observation, the SSC is responsible for confirming CH2M HILL subcontractor performance against both the subcontractor's safety plan and applicable self-assessment checklists. Self-assessment checklists contained in Attachment 6 are to be used by the SSC to review subcontractor performance.

Health and safety related communications with CH2M HILL subcontractors should be conducted as follows:

- Brief subcontractors on the provisions of this plan, and require them to sign the Employee Signoff Form included in Attachment 1.
- Request subcontractor(s) to brief the project team on the hazards and precautions related to their work.
- When apparent non-compliance/unsafe conditions or practices are observed, notify the subcontractor safety representative and require corrective action – the subcontractor is responsible for determining and implementing necessary controls and corrective actions.
- When repeat non-compliance/unsafe conditions are observed, notify the subcontractor safety representative and stop affected work until adequate corrective measures are implemented.
- When an apparent imminent danger exists, immediately remove all affected CH2M HILL employees and subcontractors, notify subcontractor safety representative, and stop affected work until adequate corrective measures are implemented. Notify the Project Manager and HSM as appropriate.
- Document all oral health and safety related communications in project field logbook, daily reports, or other records.

3.2.4 Contractors

(Reference CH2M HILL SOP HS-215, *Subcontractor, Contractor, and Owner*)

Contractor: To be determined
Contractor Contact Name:
Telephone:

This plan does not cover contractors that are contracted directly to the client or the owner. CH2M HILL is not responsible for the health and safety or means and methods of the contractor's work, and we must never assume such responsibility through our actions (e.g., advising on H&S issues). In addition to this plan, CH2M HILL staff should review contractor safety plans so that we remain aware of appropriate precautions that apply to us. Except in unusual situations when conducted by the HSM, CH2M HILL must never comment on or approve contractor safety procedures. Self-assessment checklists contained in Attachment 6 are to be used by the SSC to review the contractor's performance ONLY as it pertains to evaluating our exposure and safety.

Health and safety related communications with contractors should be conducted as follows:

- Request the contractor to brief CH2M HILL employees and subcontractors on the precautions related to the contractor's work.
- When an apparent contractor non-compliance/unsafe condition or practice poses a risk to CH2M HILL employees or subcontractors:
  - Notify the contractor safety representative
  - Request that the contractor determine and implement corrective actions
  - If needed, stop affected CH2M HILL work until contractor corrects the condition or practice. Notify the client, Project Manager, and HSM as appropriate.
- If apparent contractor non-compliance/unsafe conditions or practices are observed, inform the contractor safety representative. Our obligation is limited strictly to informing the contractor of our observation – the contractor is solely responsible for determining and implementing necessary controls and corrective actions.
- If an apparent imminent danger is observed, immediately warn the contractor employee(s) in danger and notify the contractor safety representative. Our obligation is limited strictly to immediately warning the affected individual(s) and informing the contractor of our observation – the contractor is solely responsible for determining and implementing necessary controls and corrective actions.
- Document all oral health and safety related communications in project field logbook, daily reports, or other records.

4 Personal Protective Equipment (PPE)

(Reference CH2M HILL SOP HS-117, *Personal Protective Equipment*, HS-121, *Respiratory Protection*)

PPE Specifications [a]

Task	Level	Body	Head	Respirator [b]
General site entry Surveying Observation of material loading for offsite disposal Oversight of remediation and construction	D	Work clothes; steel-toe, leather work boots; work glove.	Hardhat [c] Safety glasses Ear protection [d]	None required
Surface water sampling Aquifer testing Sediment sampling Surface soil sampling Hand augering Geoprobe boring	Modified D	Work clothes or cotton coveralls **Boots:** Steel-toe, chemical-resistant boots OR steel-toe, leather work boots with outer rubber boot covers **Gloves:** Inner surgical-style nitrile & outer chemical-resistant nitrile gloves.	Hardhat [c] Safety glasses Ear protection [d]	None required
Groundwater sampling Soil boring Investigation-derived waste (drum) sampling and disposal	Modified D	**Coveralls:** Uncoated Tyvek® **Boots:** Steel-toe, chemical-resistant boots OR steel-toe, leather work boots with outer rubber boot covers **Gloves:** Inner surgical-style nitrile & outer chemical-resistant nitrile gloves.	Hardhat [c] Splash shield [c] Safety glasses Ear protection [d]	None required.
Test pit excavation Tasks requiring upgrade	C	**Coveralls:** Polycoated Tyvek® **Boots:** Steel-toe, chemical-resistant boots OR steel-toe, leather work boots with outer rubber boot covers **Gloves:** Inner surgical-style nitrile & outer chemical-resistant nitrile gloves.	Hardhat [c] Splash shield [c] Ear protection [d] Spectacle inserts	APR, full face, MSA Ultratwin or equivalent; with GME-H cartridges or equivalent[e].

Reasons for Upgrading or Downgrading Level of Protection

Upgrade[f]	Downgrade
• Request from individual performing tasks. • Change in work tasks that will increase contact or potential contact with hazardous materials. • Occurrence or likely occurrence of gas or vapor emission. • Known or suspected presence of dermal hazards. • Instrument action levels (Section 5) exceeded.	• New information indicating that situation is less hazardous than originally thought. • Change in site conditions that decreases the hazard. • Change in work task that will reduce contact with hazardous materials.

[a] Modifications are as indicated. CH2M HILL will provide PPE only to CH2M HILL employees.
[b] No facial hair that would interfere with respirator fit is permitted.
[c] Hardhat and splash-shield areas are to be determined by the SSC.
[d] Ear protection should be worn when conversations cannot be held at distances of 3 feet or less without shouting.
[e] Cartridge change-out schedule is at least every 8 hours (or one work day), except if relative humidity is > 85%, or if organic vapor measurements are > midpoint of Level C range (refer to Section 5)--then at least every 4 hours. If encountered conditions are different than those anticipated in this HSP, contact the HSM.
[f] Performing a task that requires an upgrade to a higher level of protection (e.g., Level D to Level C) is permitted only when the PPE requirements have been approved by the HSM, and an SSC qualified at that level is present.

5 Air Monitoring/Sampling

(Reference CH2M HILL SOP HS-207 - *Exposure Assessment for Airborne Chemical Hazards)*

5.1 Air Monitoring Specifications

Instrument	Tasks	Action Levels[a]		Frequency [b]	Calibration
FID: OVA model 128 or equivalent	Geoprobe and drilling.	<1 ppm 1 to 10 ppm > 10 ppm	Level D Level C Evacuate work area and contact HSM	Initially and periodically during task	Daily
PID: OVM with 10.6eV lamp or equivalent	Geoprobe and drilling.	<1 ppm 1 to 10 ppm > 10 ppm	Level D Level C Evacuate work area and contact HSM	Initially and periodically during task	Daily
CGI: MSA model 260 or 261 or equivalent	Geoprobe and drilling.	0-10% : 10-25% LEL: >25% LEL:	No explosion hazard Potential explosion hazard Explosion hazard; evacuate or vent	Continuous during advancement of boring or trench	Daily
O_2Meter: MSA model 260 or 261 or equivalent	Geoprobe and drilling.	>25%[c] O_2: 20.9%[c] O_2: <19.5%[c] O_2:	Explosion hazard; evacuate or vent Normal O_2 O_2 deficient; vent or use SCBA	Continuous during advancement of boring or trench	Daily

[a] Action levels apply to sustained breathing-zone measurements above background.

[b] The exact frequency of monitoring depends on field conditions and is to be determined by the SSC; generally, every 5 to 15 minutes if acceptable; more frequently may be appropriate. Monitoring results should be recorded. Documentation should include instrument and calibration information, time, measurement results, personnel monitored, and place/location where measurement is taken (e.g., "Breathing Zone/MW-3", "at surface/SB-2", etc.).

[c] If the measured percent of O_2 is less than 10, an accurate LEL reading will not be obtained. Percent LEL and percent O_2 action levels apply only to ambient working atmospheres, and not to confined-space entry. More-stringent percent LEL and O_2 action levels are required for confined-space entry (refer to Section 2).

[d] Refer to SOP HS-10 for instructions and documentation on radiation monitoring and screening.

[e] Noise monitoring and audiometric testing also required.

5.2 Calibration Specifications

(Refer to the respective manufacturer's instructions for proper instrument-maintenance procedures)

Instrument	Gas	Span	Reading	Method
PID: OVM, 10.6 or 11.8 eV bulb	100 ppm isobutylene	RF = 1.0	100 ppm	1.5 lpm reg T-tubing
PID: MiniRAE, 10.6 eV bulb	100 ppm isobutylene	CF = 100	100 ppm	1.5 lpm reg T-tubing
PID: TVA 1000	100 ppm isobutylene	CF = 1.0	100 ppm	1.5 lpm reg T-tubing
FID: OVA	100 ppm methane	3.0 $\pm$ 1.5	100 ppm	1.5 lpm reg T-tubing
FID: TVA 1000	100 ppm methane	NA	100 ppm	2.5 lpm reg T-tubing
Dust Monitor: Miniram-PDM3	Dust-free air	Not applicable	0.00 mg/m^3 in "Measure" mode	Dust-free area OR Z-bag with HEPA filter
CGI: MSA 260, 261, 360, or 361	0.75% pentane	N/A	50% LEL $\pm$ 5% LEL	1.5 lpm reg direct tubing

5.3 Air Sampling

Sampling, in addition to real-time monitoring, may be required by other OSHA regulations where there may be exposure to certain contaminants. Air sampling typically is required when site contaminants include lead, cadmium, arsenic, asbestos, and certain volatile organic compounds. Contact the HSM immediately if these contaminants are encountered.

Method Description

None anticipated.

Personnel and Areas

Results must be sent immediately to the HSM. Regulations may require reporting to monitored personnel. Results reported to:

HSM: Michael Goldman/ATL
Other: Dan Young/NVR

6 Decontamination

(Reference CH2M HILL SOP HS-506, *Decontamination*)

The SSC must establish and monitor the decontamination procedures and their effectiveness. Decontamination procedures found to be ineffective will be modified by the SSC. The SSC must ensure that procedures are established for disposing of materials generated on the site.

6.1 Decontamination Specifications

Personnel

- Boot wash/rinse
- Glove wash/rinse
- Outer-glove removal
- Body-suit removal
- Inner-glove removal
- Respirator removal
- Hand wash/rinse
- Face wash/rinse
- Shower ASAP
- Dispose of PPE in municipal trash, or contain for disposal
- Dispose of personnel rinse water to facility or sanitary sewer, or contain for offsite disposal

Sample Equipment

- Wash/rinse equipment
- Solvent-rinse equipment
- Contain solvent waste for offsite disposal

Heavy Equipment

- Power wash
- Steam clean
- Dispose of equipment rinse water to facility or sanitary sewer, or contain for offsite disposal

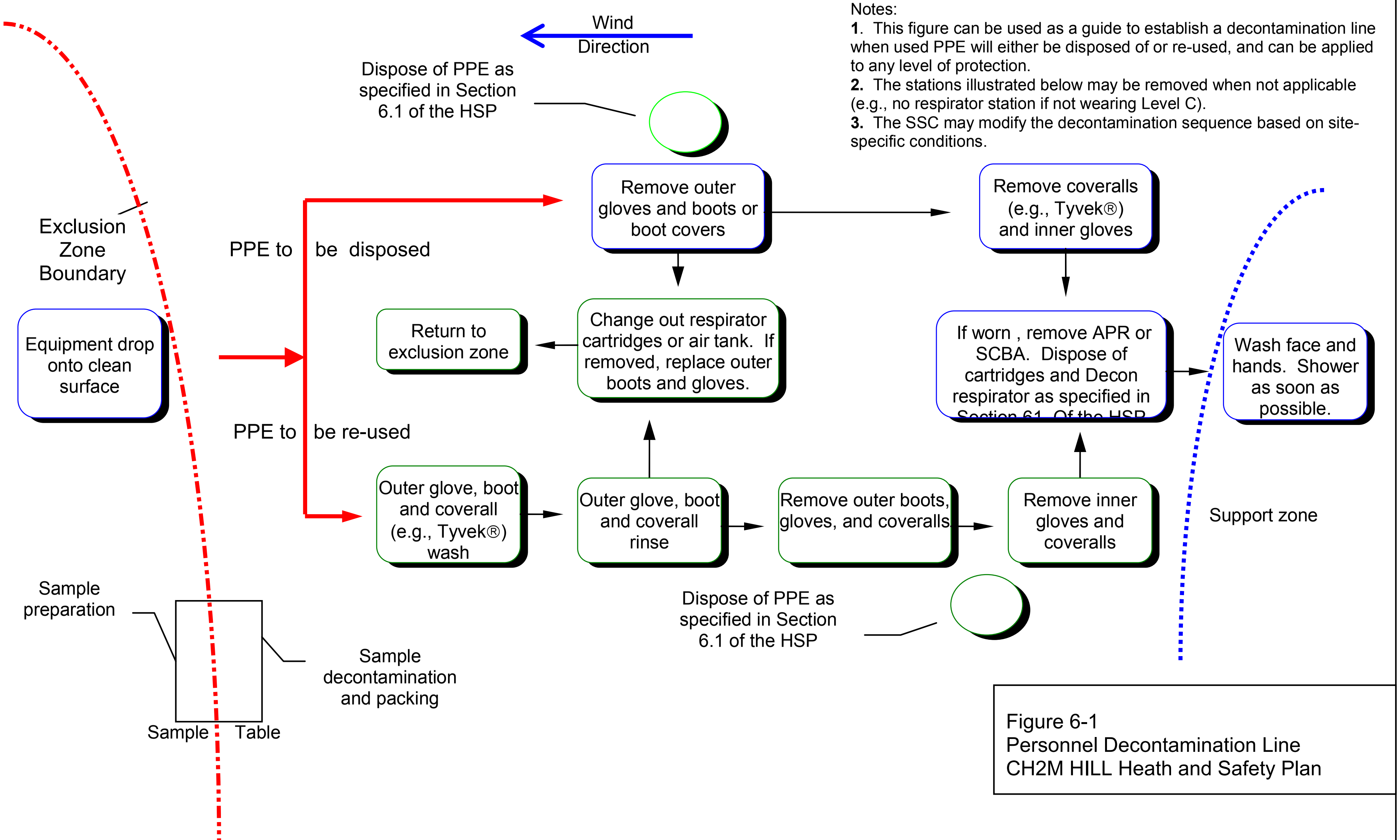
6.2 Diagram of Personnel-Decontamination Line

No eating, drinking, or smoking is permitted in contaminated areas and in exclusion or decontamination zones. The SSC should establish areas for eating, drinking, and smoking. Contact lenses are not permitted in exclusion or decontamination zones.

Figure 6-1 illustrates a conceptual establishment of work zones, including the decontamination line. Work zones are to be modified by the SSC to accommodate task-specific requirements.

7 Spill-Containment Procedures

Sorbent material will be maintained in the support zone. Incidental spills will be contained with sorbent and disposed of properly.



Notes:
1. This figure can be used as a guide to establish a decontamination line when used PPE will either be disposed of or re-used, and can be applied to any level of protection.
2. The stations illustrated below may be removed when not applicable (e.g., no respirator station if not wearing Level C).
3. The SSC may modify the decontamination sequence based on site-specific conditions.

Figure 6-1
Personnel Decontamination Line
CH2M HILL Heath and Safety Plan

8 Site-Control Plan

8.1 Site-Control Procedures

(Reference CH2M HILL SOP HS-510, *Site Control)*

- The SSC will conduct a site safety briefing (see below) before starting field activities or as tasks and site conditions change.
- Topics for briefing on site safety: general discussion of Health and Safety Plan, site-specific hazards, locations of work zones, PPE requirements, equipment, special procedures, emergencies.
- The SSC records attendance at safety briefings in a logbook and documents the topics discussed.
- Post the OSHA job-site poster in a central and conspicuous location in accordance with CH2M HILL SOP HS-71, *OSHA Postings*.
- Establish support, decontamination, and exclusion zones. Delineate with flags or cones as appropriate. Support zone should be upwind of the site. Use access control at entry and exit from each work zone.
- Establish onsite communication consisting of the following:
  - Line-of-sight and hand signals
  - Air horn
  - Two-way radio or cellular telephone if available
- Establish offsite communication.
- Establish and maintain the “buddy system.”
- Initial air monitoring is conducted by the SSC in appropriate level of protection.
- The SCC is to conduct periodic inspections of work practices to determine the effectiveness of this plan – refer to Sections 2 and 3. Deficiencies are to be noted, reported to the HSM, and corrected.

8.2 UXO Site Control

The UXO Technician III coordinates access control and security on site. Due to the hazardous nature of MEC work, only authorized personnel will be allowed in the exclusion zone (EZ). The EZ is the work site encompassing an area large enough to prevent personnel injuries from fragmentation and overpressure resulting from either an unintentional or intentional detonation of MEC.

During all intrusive operations the EZ will be a radius of 400 feet minimum (MK II Grenade) (distance from DDESP TP-16, Chapter 4). During UXO operations, only UXO trained or authorized essential personnel are allowed in the EZ. Authorized personnel are those that have completed the required training, meet medical requirements and are essential to the ongoing operation.

During all operations on site, the site UXO Technician III will cease operations if non-essential personnel are observed within the operating area (EZ). During duty hours, personnel will provide security at the site. Equipment will be returned to a designated area and secured at the end of each work day. Future site control measures to ensure safety are as follows;

- Eating, drinking and smoking are prohibited except in designated areas;
- MEC operations will cease if non-UXO trained or non-essential personnel are present;
- The UXO Technician III will escort all authorized visitors to the site;
- The UXO Technician III will maintain the site entry control log to ensure accurate accountability of personnel;
- The UXO Technician III will brief this UXO Avoidance Plan to all personnel entering the site to inform them of the potential site hazards. All personnel will acknowledge this briefing by signing the briefing log;
- In case of an emergency, personnel will exit the site and move to the designated safe area. The safe area will be located upwind of the site and outside of the fragmentation (400 feet) area. The UXO Technician III will assist in determining the severity of the emergency. If the emergency warrants evacuation, the UXO Technician III will notify the Project Manager.

8.2 Hazwoper Compliance Plan

(Reference CH2M HILL SOP HS-220, *Site-Specific Written Safety Plans)*

Certain parts of the site work are covered by state or federal Hazwoper standards and therefore require training and medical monitoring. Anticipated Hazwoper tasks (Section 1.1.1) might occur consecutively or concurrently with respect to non-Hazwoper tasks. This section outlines procedures to be followed when approved activities specified in Section 1.1.2 do not require 24- or 40-hour training. Non-Hazwoper-trained personnel also must be trained in accordance with all other state and federal OSHA requirements.

- In many cases, air sampling, in addition to real-time monitoring, must confirm that there is no exposure to gases or vapors before non-Hazwoper-trained personnel are allowed on the site, or while non-Hazwoper-trained staff are working in proximity to Hazwoper activities. Other data (e.g., soil) also must document that there is no potential for exposure. The HSM must approve the interpretation of these data. Refer to subsections 2.5 and 5.3 for contaminant data and air sampling requirements, respectively.
- When non-Hazwoper-trained personnel are at risk of exposure, the SSC must post the exclusion zone and inform non-Hazwoper-trained personnel of the:
  - nature of the existing contamination and its locations
  - limitations of their access
  - emergency action plan for the site
- Periodic air monitoring with direct-reading instruments conducted during regulated tasks also should be used to ensure that non-Hazwoper-trained personnel (e.g., in an adjacent area) are not exposed to airborne contaminants.
- When exposure is possible, non-Hazwoper-trained personnel must be removed from the site until it can be demonstrated that there is no longer a potential for exposure to health and safety hazards.
- Remediation treatment system start-ups: Once a treatment system begins to pump and treat contaminated media, the site is, for the purposes of applying the Hazwoper standard, considered a treatment, storage, and disposal facility (TSDF). Therefore, once the system begins operation, only Hazwoper-trained personnel (minimum of 24 hour of training) will be permitted to enter the site. All non-Hazwoper-trained personnel must not enter the TSDF area of the site.

9 Emergency Response Plan

(Reference CH2M HILL, SOP HS-106, *Emergency Response*)

9.1 Pre-Emergency Planning

The SSC performs the applicable pre-emergency planning tasks before starting field activities and coordinates emergency response with CH2M HILL onsite parties, the facility, and local emergency-service providers as appropriate.

- Review the facility emergency and contingency plans where applicable.
- Determine what onsite communication equipment is available (e.g., two-way radio, air horn).
- Determine what offsite communication equipment is needed (e.g., nearest telephone, cell phone).
- Confirm and post emergency telephone numbers, evacuation routes, assembly areas, and route to hospital; communicate the information to onsite personnel.
- Field Trailers: Post “Exit” signs above exit doors, and post “Fire Extinguisher” signs above locations of extinguishers. Keep areas near exits and extinguishers clear.
- Review changed site conditions, onsite operations, and personnel availability in relation to emergency response procedures.
- Where appropriate and acceptable to the client, inform emergency room and ambulance and emergency response teams of anticipated types of site emergencies.
- Designate one vehicle as the emergency vehicle; place hospital directions and map inside; keep keys in ignition during field activities.
- Inventory and check site emergency equipment, supplies, and potable water.
- Communicate emergency procedures for personnel injury, exposures, fires, explosions, and releases.
- Rehearse the emergency response plan before site activities begin, including driving route to hospital.
- Brief new workers on the emergency response plan.

The SSC will evaluate emergency response actions and initiate appropriate follow-up actions.

9.2 Emergency Equipment and Supplies

The SSC should mark the locations of emergency equipment on the site map and post the map.

Emergency Equipment and Supplies	Location
20 LB (or two 10-lb) fire extinguisher (A, B, and C classes)	Support Zone/Heavy Equipment
First aid kit	Support Zone/Field Vehicle
Eye Wash	Support & Decon Zone/Field Vehicle
Potable water	Support & Decon Zone/Field Vehicle
Bloodborne-pathogen kit	Support Zone/Field Vehicle
Additional equipment (specify):	

9.3 Incident Response

In fires, explosions, or chemical releases, actions to be taken include the following:

- Shut down CH2M HILL operations and evacuate the immediate work area.
- Notify appropriate response personnel.
- Account for personnel at the designated assembly area(s).
- Assess the need for site evacuation, and evacuate the site as warranted.

Instead of implementing a work-area evacuation, note that small fires or spills posing minimal safety or health hazards may be controlled.

9.4 Emergency Medical Treatment

The procedures listed below may also be applied to non-emergency incidents. Injuries and illnesses (including overexposure to contaminants) must be reported to Human Resources. If there is doubt about whether medical treatment is necessary, or if the injured person is reluctant to accept medical treatment, contact the CH2M HILL medical consultant. During non-emergencies, follow these procedures as appropriate.

- Notify appropriate emergency response authorities listed in Section 9.8 (e.g., 911).
- The SCC will assume charge during a medical emergency until the ambulance arrives or until the injured person is admitted to the emergency room.
- Prevent further injury.
- Initiate first aid and CPR where feasible.
- Get medical attention immediately.
- Perform decontamination where feasible; lifesaving and first aid or medical treatment take priority.
- Make certain that the injured person is accompanied to the emergency room.
- When contacting the medical consultant, state that the situation is a CH2M HILL matter, and give your name and telephone number, the name of the injured person, the extent of the injury or exposure, and the name and location of the medical facility where the injured person was taken.
- Report incident as outlined in Section 9.7.

9.5 Evacuation

- Evacuation routes and assembly areas (and alternative routes and assembly areas) are specified on the site map.
- Evacuation route(s) and assembly area(s) will be designated by the SSC before work begins.
- Personnel will assemble at the assembly area(s) upon hearing the emergency signal for evacuation.
- The SSC and a “buddy” will remain on the site after the site has been evacuated (if safe) to assist local responders and advise them of the nature and location of the incident.
- The SSC will account for all personnel in the onsite assembly area.
- A designated person will account for personnel at alternate assembly area(s).
- The SSC will write up the incident as soon as possible after it occurs and submit a report to the Corporate Director of Health and Safety.

9.6 Evacuation Signals

Signal	Meaning
Grasping throat with hand	Emergency-help me.
Thumbs up	OK; understood.
Grasping buddy’s wrist	Leave area now.
Continuous sounding of horn	Emergency; leave site now.

9.7 Incident Notification and Reporting

- Upon any project incident (fire, spill, injury, near miss, death, etc.), immediately notify the PM and HSM. Call emergency beeper number if HSM is unavailable.
- For CH2M HILL work-related injuries or illnesses, contact and help Human Resources administrator complete an Incident Report Form (IRF). IRF must be completed within 24 hours of incident.
- For CH2M HILL subcontractor incidents, complete the Subcontractor Accident/Illness Report Form and submit to the HSM.
- Notify and submit reports to client as required in contract.

10 Approval

This site-specific Health and Safety Plan has been written for use by CH2M HILL only. CH2M HILL claims no responsibility for its use by others unless that use has been specified and defined in project or contract documents. The plan is written for the specific site conditions, purposes, dates, and personnel specified and must be amended if those conditions change.

10.1 Original Plan

Written By: **Ed Corack/WDC**
Dan Young/NVR
Date: 08/24/05

Approved By: Michael Goldman **Date: September 2, 2005**

10.2 Revisions

Revisions Made By: Tom Roth/ATL **Date:9/25/2006**

Revisions to Plan:Updated for MEC intrusive investigation.

Revisions Approved By: **Date:**

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11 Attachments

Attachment 1:	Employee Signoff Form – Field Safety Instructions
Attachment 2:	Project-Specific Chemical Product Hazard Communication Form
Attachment 3:	Chemical-Specific Training Form
Attachment 4:	Emergency Contacts
Attachment 5:	Project H&S Forms/Permits
Attachment 6:	Project Activity Self-Assessment Checklists
Attachment 7:	Applicable Material Safety Data Sheets

CH2MHILL

EMPLOYEE SIGNOFF FORM

Health and Safety Plan

- The CH2M HILL project employees and subcontractors listed below have been provided with a copy of this HSP, have read and understood it, and agree to abide by its provisions.

Project Name: CLEAN III CTO-109 / MCB Camp Lejeune, Knox Trailer Park **Project Number:** 330966

EMPLOYEE NAME (Please print)	**EMPLOYEE SIGNATURE**	**COMPANY**	**DATE**

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Project-Specific Chemical Product Hazard Communication Form

This form must be completed prior to performing activities that expose personnel to hazardous chemicals products. Upon completion of this form, the SSC shall verify that training is provided on the hazards associated with these chemicals and the control measures to be used to prevent exposure to CH2M HILL and subcontractor personnel. Labeling and MSDS systems will also be explained.

Project Name: CLEAN III CTO-109 / MCB Camp Lejeune, Knox Trailer Park **Project Number:** 330966

MSDSs will be maintained at the following location(s):

Hazardous Chemical Products Inventory

Chemical	Quantity	Location	MSDS Available	Container labels: Identity	Container labels: Hazard
Methane	1 liter, compressed	Support Zone			
Isobutylene	1 liter, compressed	Support Zone			
Pentane	1 liter, compressed	Support Zone			
Hydrochloric acid	< 500 ml	Support Zone / sample bottles			
Nitric acid	< 500 ml	Support Zone / sample bottles			
Sulfuric Acid	< 500 ml	Support Zone / sample bottles			
Sodium hydroxide	< 500 ml	Support Zone / sample bottles			
Methanol	< 1 Gallon	Support/Decon Zones			
Hexane	< 1 Gallon	Support/Decon Zones			
pH buffers	< 500 ml	Support Zone			
MSA Sanitizer	< 1 liter	Support/Decon Zones			
Alconox/Liquinox	< 1liter	Support/Decon Zones			

Refer to SOP HS-05 *Hazard Communication* for more detailed information.

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CHEMICAL-SPECIFIC TRAINING FORM

Location:	Project #: 330966
HCC:	Trainer:

TRAINING PARTICIPANTS:

NAME	SIGNATURE	NAME	SIGNATURE

REGULATED PRODUCTS/TASKS COVERED BY THIS TRAINING:

The HCC shall use the product MSDS to provide the following information concerning each of the products listed above.

☐ Physical and health hazards

☐ Control measures that can be used to provide protection (including appropriate work practices, emergency procedures, and personal protective equipment to be used)

☐ Methods and observations used to detect the presence or release of the regulated product in the workplace (including periodic monitoring, continuous monitoring devices, visual appearance or odor of regulated product when being released, etc.)

Training participants shall have the opportunity to ask questions concerning these products and, upon completion of this training, will understand the product hazards and appropriate control measures available for their protection.

Copies of MSDSs, chemical inventories, and CH2M HILL's written hazard communication program shall be made available for employee review in the facility/project hazard communication file.

EMERGENCY CONTACTS

If an injury occurs, notify the injured person's personnel office as soon as possible after obtaining medical attention for the injured person. Notification MUST be made within 24 hours of the injury.

24-hour CH2M HILL Emergency Beeper – 888/444-1226

Medical Emergency – 911 or Hospital ER (On-Base) #: (910) 451-4840 (910) 451-4841 (910) 451-4842 Onslow County ER (Off-Base) #: (910) 577-2240 Ambulance (On-Base) #: (910) 451-3004 (910) 451-3005 Ambulance (Public) #: (910) 451-9111 LEPC (Poison Control)#: (800) 222-1222	**CH2M HILL Medical Consultant** Dr. Peter Greaney GMG WorkCare, Orange, CA 800/455-6155 (After hours calls will be returned within 20 minutes)
Fire/Spill Emergency – 911 or Base Fire Response #: (910) 451-9111	**Local Occupational Physician** Occupational Medicine Specialists 4815 Oleander Dr. Wilmington, NC 28403 910 452-1111
Security & Police – 911 or Base Security #: (910) 451-2555	**Corporate Director Health and Safety** Name: Mollie Netherland/SEA Phone: 206/453-5005 **24-hour emergency beeper: 888-444-1226**
On-Scene Coordinator Name: Fire Chief Phone: (910) 451-5815	**Environmental Management Division (EMD)** Names: Bob Lowder Phone: (910) 451-9607
Utilities Emergency Water: Gas: Contact Base EMD Electric:	**Health and Safety Manager (HSM)** Name: Michael Goldman/ATL Phone: (770) 604-9182 x 396
Designated Safety Coordinator (DSC) see Site-Specific HASP Name: Phone:	**Regional Human Resources Department** Name: Mary Jo Jordan/GNV Phone: 352/355-2867
Project Manager see Site-Specific HASP Name: Phone:	**Corporate Human Resources Department** Name: John Monark/COR Phone: 303/771-0900
Federal Express Dangerous Goods Shipping Phone: 800/238-5355 **CH2M HILL Emergency Number for Shipping Dangerous Goods** Phone: 800/255-3924	**Worker's Compensation and Auto Claims** Sterling Administration Services Phone: 800/420-8926 After hours: 800/497-4566 Report fatalities AND report vehicular accidents involving pedestrians, motorcycles, or more than two cars.

Contact the Project Manager. Generally, the Project Manager will contact relevant government agencies.

Facility Alarms: TBD	**Evacuation Assembly Area(s):** TBD by the SC-HW; will probably be the local hotel where the field team is staying

Facility/Site Evacuation Route(s): follow main roads towards access gates and off the Base

Route to Hospital: (Depends on location within base area (refer to attached Figures 12-1 and 12-2)

Nearest On-Base hospital:
Base Naval Hospital (only to be used in extreme emergency)
Building NH100
100 Brewster Blvd.
Camp Lejeune, NC 28547
Phone: (910) 451-4840, (910) 451-4841, (910) 451-4842

Local hospital:
Onslow County Memorial Hospital
317 Western Boulevard
Jacksonville, NC 28546
Phone: (910) 577-2240

Local ambulance service:
Base Ambulance: (910) 451-3004, (910) 451-3005
Public Ambulance: (910) 451-9111

From MCB Camp Lejeune

Directions to the Base Naval Hospital (Building NH100)
(nearest hospital; only to be used in an extreme emergency)

1. Proceed north to Holcomb Boulevard (towards Highway 24).
2. Turn left onto Brewster Boulevard (heading west)
3. Continue on Brewster Boulevard until intersection with the driveway to the Naval Hospital.
4. Turn onto Hospital driveway, and proceed to emergency room.

Directions to Onslow County Memorial Hospital :

1. From Holcomb Boulevard, exit Base through main gate.
2. Follow Highway 24 west until intersecting with Western Boulevard.
3. Turn right onto Western Boulevard.
4. The Onslow County Memorial Hospital is on the left, approximately 2 miles (fifth stop light) from Highway 24.
5. Follow the signs to the emergency room.

From Air Station and Camp Geiger

Directions to Onslow County Memorial Hospital:

1. Proceed through the main gate, turn right, and head north on Ocean Highway 17.
2. Follow Ocean Highway 17 north to Highway 24 and head east.
3. Travel east until Western Boulevard, turn left onto Western Boulevard.
4. The Onslow County Memorial Hospital is on the left, approximately 2 miles (fifth stop light) from Highway 24.

Follow the signs to the emergency room.

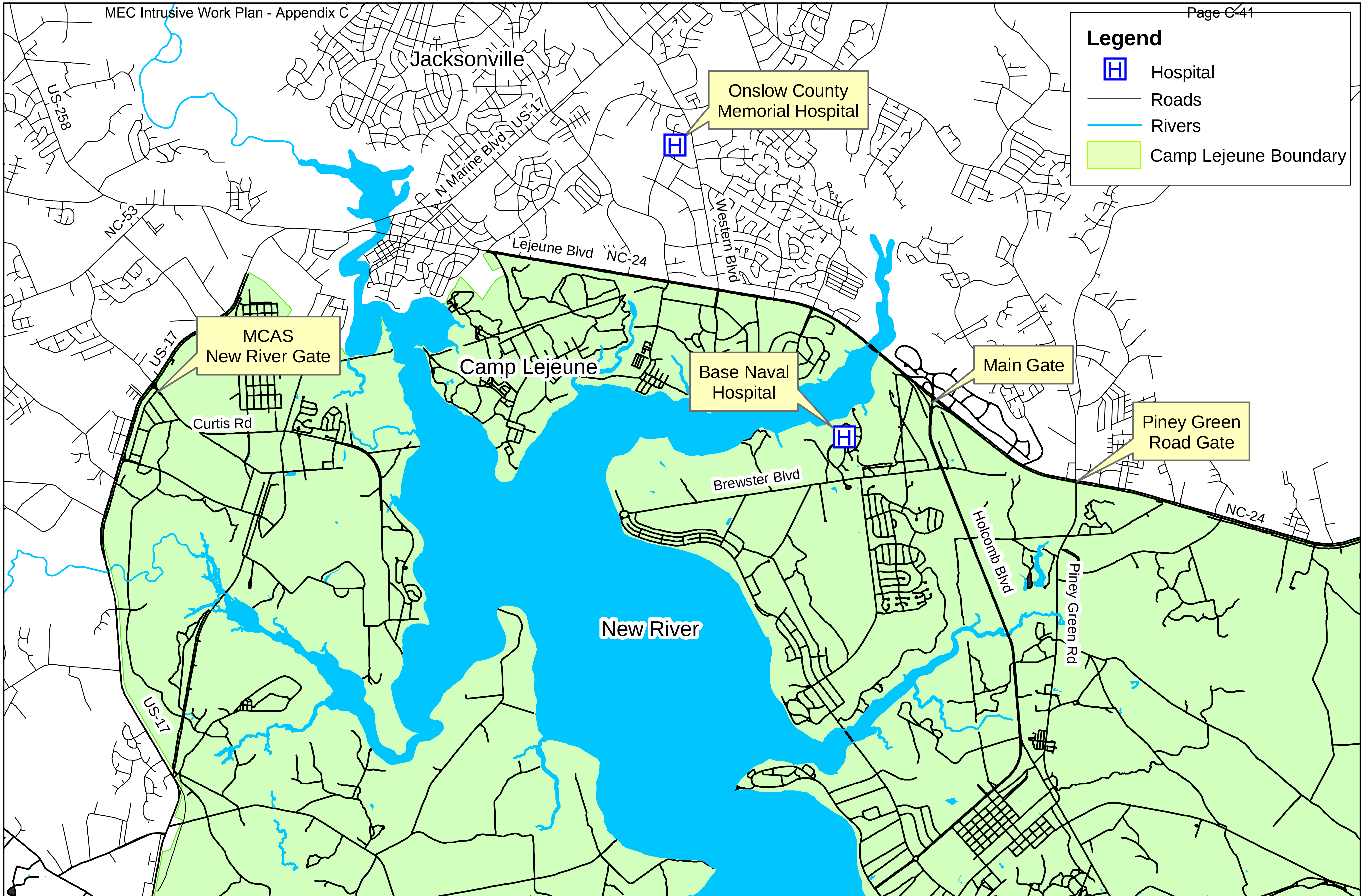

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Figure 12-1
Route to Hospitals
Marine Corps Base, Camp Lejeune
North Carolina

P:/Proj/EBL/Navy Clean/Clean 2/CTO 139/Master Plans/Master HASP/Figures

\\Aphrodite\proj\USNavFaceNGCom\315007CampLejeune\Projects\Figure 2- Base Overview.mxd

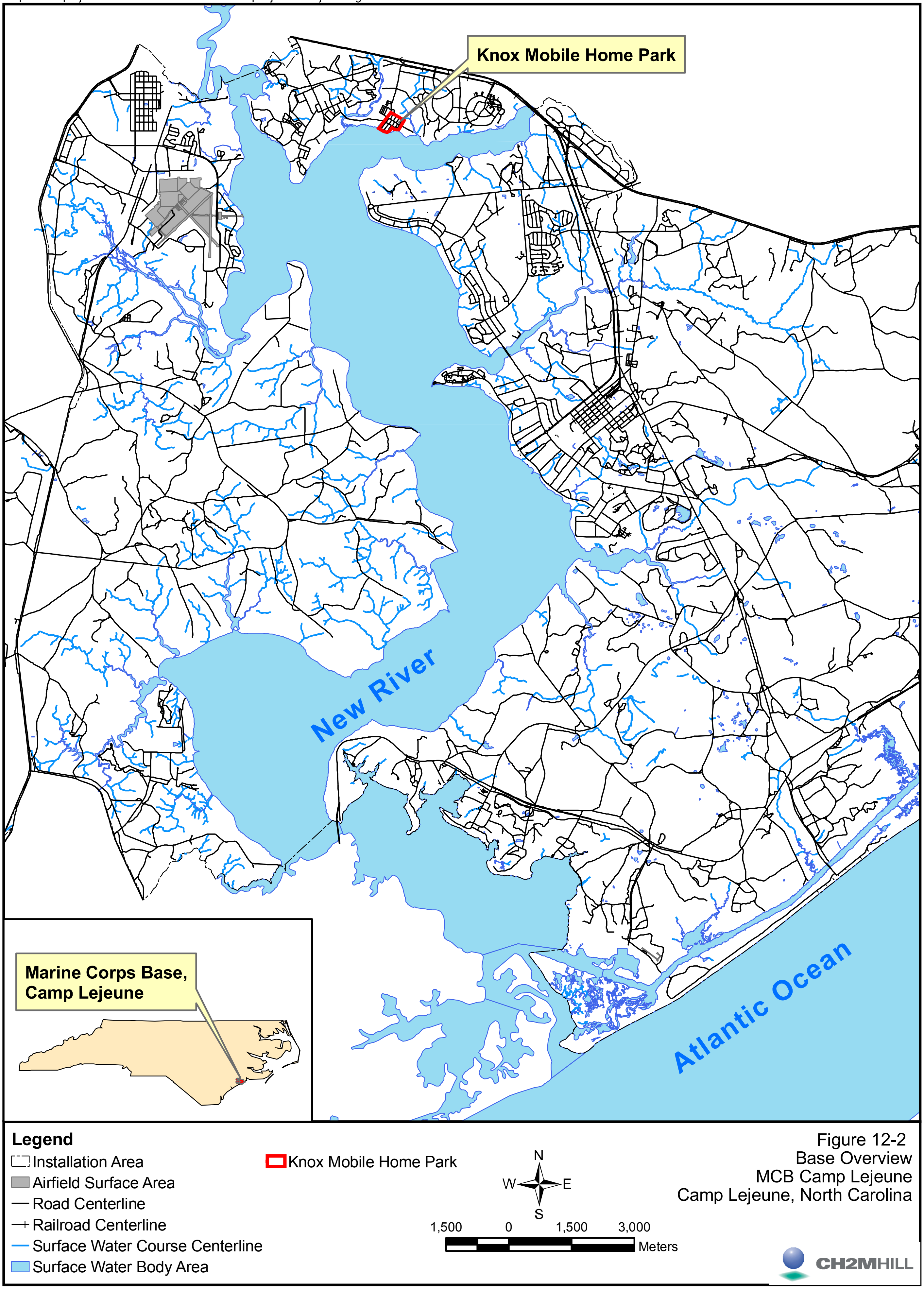

Figure 12-2
Base Overview
MCB Camp Lejeune
Camp Lejeune, North Carolina

CH2M HILL HEALTH AND SAFETY PLAN

Attachment 5

Project H&S Forms and Permits

To be completed as needed for task specific operations.

CH2M HILL HEALTH AND SAFETY PLAN

Attachment 6

Project Activity Self-Assessment Checklists

This checklist shall be used by CH2M HILL personnel **only** and shall be completed at the frequency specified in the project's HSP/FSI.

This checklist is to be used at locations where: 1) CH2M HILL employees are potentially exposed to hazards associated with drilling operations (complete Sections 1 and 3), and/or 2) CH2M HILL oversight of a drilling subcontractor is required (complete entire checklist).

SSC/DSC may consult with drilling subcontractors when completing this checklist, but shall not direct the means and methods of drilling operations nor direct the details of corrective actions. Drilling subcontractors shall determine how to correct deficiencies and we must carefully rely on their expertise. Items considered to be imminently dangerous (possibility of serious injury or death) shall be corrected immediately or all exposed personnel shall be removed from the hazard until corrected.

Completed checklists shall be sent to the health and safety manager for review.

Project Name: ______________________ Project No.: ______________

Location: ______________________ PM: ______________

Auditor: ______________ Title: ______________ Date: ________

This specific checklist has been completed to:

☐ Evaluate CH2M HILL employee exposures to drilling hazards
☐ Evaluate a CH2M HILL subcontractor's compliance with drilling H&S requirements
Subcontractors Name: ______________________

- Check "Yes" if an assessment item is complete/correct.
- Check "No" if an item is incomplete/deficient. Deficiencies shall be brought to the immediate attention of the drilling subcontractor. Section 3 must be completed for all items checked "No."
- Check "N/A" if an item is not applicable.
- Check "N/O" if an item is applicable but was not observed during the assessment.

Numbers in parentheses indicate where a description of this assessment item can be found in Standard of Practice HS-35.

SECTION 1	Yes	No	N/A	N/O
PERSONNEL SAFE WORK PRACTICES (3.1)				
1. Only authorized personnel operating drill rig	☐	☐	☐	☐
2. Personnel cleared during rig startup	☐	☐	☐	☐
3. Personnel clear of rotating parts	☐	☐	☐	☐
4. Personnel not positioned under hoisted loads	☐	☐	☐	☐
5. Loose clothing and jewelry removed	☐	☐	☐	☐
6. Personnel instructed not to approach equipment that has become electrically energized	☐	☐	☐	☐
7. Smoking is prohibited around drilling operation	☐	☐	☐	☐
8. Personnel wearing appropriate PPE, per HSP/FSI	☐	☐	☐	☐

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SECTION 2	Yes	No	N/A	N/O
GENERAL (3.2.1)				
9. Daily safety briefing/meeting conducted with crew	☐	☐	☐	☐
10. Daily inspection of drill rig and equipment conducted before use	☐	☐	☐	☐
DRILL RIG PLACEMENT (3.2.2)				
11. Location of underground utilities identified	☐	☐	☐	☐
12. Safe clearance distance maintained from overhead powerlines	☐	☐	☐	☐
13. Drilling pad established, when necessary	☐	☐	☐	☐
14. Drill rig leveled and stabilized	☐	☐	☐	☐
DRILL RIG TRAVEL (3.2.3)				
15. Rig shut down and mast lowered and secured prior to rig movement	☐	☐	☐	☐
16. Tools and equipment secured prior to rig movement	☐	☐	☐	☐
17. Only personnel seated in cab are riding on rig during movement	☐	☐	☐	☐
18. Safe clearance distance maintained while traveling under overhead powerlines	☐	☐	☐	☐
19. Backup alarm or spotter used when backing rig	☐	☐	☐	☐
DRILL RIG OPERATION (3.2.4)				
20. Kill switch clearly identified and operational	☐	☐	☐	☐
21. All machine guards are in place	☐	☐	☐	☐
22. Rig ropes not wrapped around body parts	☐	☐	☐	☐
23. Pressurized lines and hoses secured from whipping hazards	☐	☐	☐	☐
24. Drill operation stopped during inclement weather	☐	☐	☐	☐
25. Air monitoring conducted per HSP/FSI for hazardous atmospheres	☐	☐	☐	☐
26. Rig placed in neutral when operator not at controls	☐	☐	☐	☐
DRILL RIG MAINTENANCE (3.2.5)				
27. Defective components repaired immediately	☐	☐	☐	☐
28. Lockout/tagout procedures used prior to maintenance	☐	☐	☐	☐
29. Cathead in clean, sound condition	☐	☐	☐	☐
30. Drill rig ropes in clean, sound condition	☐	☐	☐	☐
31. Fall protection used for fall exposures of 6 feet or greater	☐	☐	☐	☐
32. Rig in neutral and augers stopped rotating before cleaning	☐	☐	☐	☐
33. Good housekeeping maintained on and around rig	☐	☐	☐	☐
DRILLING AT HAZARDOUS WASTE SITES (3.2.6)				
34. Waste disposed of according to HSP	☐	☐	☐	☐
35. Appropriate decontamination procedures being followed, per HSP	☐	☐	☐	☐

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SECTION 3

Complete this section for all items checked "No" in Sections 1 or 2. Deficient items must be corrected in a timely manner.

Item #	Corrective Action Planned/Taken	Date Corrected

H&S Self-Assessment Checklist - EARTHMOVING EQUIPMENT

This checklist shall be used by CH2M HILL personnel **only** and shall be completed at the frequency specified in the project's HSP/FSI.

This checklist is to be used at locations where: 1) CH2M HILL employees are potentially exposed to hazards associated with earthmoving equipment operations (complete Sections 1 and 3), and/or 2) CH2M HILL oversight of a earthmoving equipment subcontractor is required (complete entire checklist).

SSC/DSC may consult with earthmoving equipment subcontractors when completing this checklist, but shall not direct the means and methods of equipment operations nor direct the details of corrective actions. Earthmoving equipment subcontractors shall determine how to correct deficiencies and we must carefully rely on their expertise. Items considered to be imminently dangerous (possibility of serious injury or death) shall be corrected immediately or all exposed personnel shall be removed from the hazard until corrected.

Completed checklists shall be sent to the health and safety manager for review.

Project Name: ______________________________ Project No.: ______________

Location: ______________________________ PM: ______________________

Auditor: ____________________ Title: ____________________ Date: ________

This specific checklist has been completed to:

☐ Evaluate CH2M HILL employee exposures to earthmoving equipment hazards
☐ Evaluate a CH2M HILL subcontractor's compliance with earthmoving equipment H&S requirements
Subcontractors Name: ______________________________

- Check "Yes" if an assessment item is complete/correct.
- Check "No" if an item is incomplete/deficient. Deficiencies shall be brought to the immediate attention of the earthmoving equipment subcontractor. Section 3 must be completed for all items checked "No."
- Check "N/A" if an item is not applicable.
- Check "N/O" if an item is applicable but was not observed during the assessment.

Numbers in parentheses indicate where a description of this assessment item can be found in Standard of Practice HS-27.

SECTION 1	Yes	No	N/A	N/O
PERSONNEL SAFE WORK PRACTICES (3.1)				
1. Only authorized personnel operating earthmoving equipment	☐	☐	☐	☐
2. Personnel maintaining safe distance from operating equipment	☐	☐	☐	☐
3. Personnel and equipment operator in close communication when personnel must be in proximity of operating equipment	☐	☐	☐	☐
4. Personnel approach operating equipment safely	☐	☐	☐	☐
5. Personnel wearing high-visibility and/or reflective vests when close to operating equipment	☐	☐	☐	☐
6. Personnel riding only in seats of equipment cab and using seat belts	☐	☐	☐	☐
7. Personnel not positioned under hoisted loads	☐	☐	☐	☐
8. Personnel not hoisted by equipment	☐	☐	☐	☐
9. Personnel instructed not to approach equipment that has become electrically energized	☐	☐	☐	☐
10. Personnel wearing appropriate PPE, per HSP/FSI	☐	☐	☐	☐

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SECTION 2

	Yes	No	N/A	N/O
GENERAL (3.2.1)				
11. Daily safety briefing/meeting conducted with crew	☐	☐	☐	☐
12. Daily inspection of equipment and equipment accessories conducted before use	☐	☐	☐	☐
13. At least one fire extinguisher available at the equipment operating area	☐	☐	☐	☐
EARTHMOVING EQUIPMENT COMPONENTS (3.2.2)				
14. Backup alarm or spotter used when backing equipment	☐	☐	☐	☐
15. Operational horn provided on bi-directional equipment	☐	☐	☐	☐
16. Seat belts are provided and used	☐	☐	☐	☐
17. Rollover protective structures (ROPS) provided	☐	☐	☐	☐
18. Braking system capable of stopping full payload	☐	☐	☐	☐
19. Headlights and taillights operable when additional light required	☐	☐	☐	☐
20. Brake lights in operable condition	☐	☐	☐	☐
21. Cab glass provides no visible distortion to the operator	☐	☐	☐	☐
22. Hauling equipment (dump trucks) provided with cab shield or canopy	☐	☐	☐	☐
23. Dump truck beds provided with positive means of support during maintenance or inspection	☐	☐	☐	☐
24. Dump truck operating levers provided with latch to prevent accidental dumping	☐	☐	☐	☐
EARTHMOVING EQUIPMENT PLACEMENT (3.2.3)				
25. Location of underground utilities identified	☐	☐	☐	☐
26. Safe clearance distance maintained while working under overhead powerlines	☐	☐	☐	☐
27. Safe distance is maintained while traveling under powerlines	☐	☐	☐	☐
28. Unattended equipment visibly marked at night	☐	☐	☐	☐
29. Parking brake set when equipment parked and equipment chocked when parked on incline	☐	☐	☐	☐
EARTHMOVING EQUIPMENT OPERATION (3.2.4)				
30. Equipment operated on safe roadways and grades	☐	☐	☐	☐
31. Equipment operated at safe speed	☐	☐	☐	☐
32. Equipment not operated during inclement weather, lightning storms	☐	☐	☐	☐
33. Using equipment to lift loads, other than earth, done according to equipment manufacturer specifications	☐	☐	☐	☐
34. Lifting and hauling capacities are not exceeded	☐	☐	☐	☐
35. Equipment components lowered when not in use	☐	☐	☐	☐
36. All machine guards are in place	☐	☐	☐	☐
37. Air monitoring conducted per HSP/FSI for hazardous atmospheres	☐	☐	☐	☐
EARTHMOVING EQUIPMENT MAINTENANCE (3.2.5)				
38. Defective components repaired immediately	☐	☐	☐	☐
39. Suspended equipment or equipment parts are supported prior to work under or between	☐	☐	☐	☐
40. Lockout/tagout procedures used prior to maintenance	☐	☐	☐	☐
41. Tires on split rims removed using safety tire rack or cage	☐	☐	☐	☐
42. Good housekeeping maintained on and around equipment	☐	☐	☐	☐
EXCAVATING AT HAZARDOUS WASTE SITES (3.2.6)				
43. Waste disposed of according to HSP	☐	☐	☐	☐
44. Appropriate decontamination procedures being followed, per HSP	☐	☐	☐	☐

SECTION 3

Complete this section for all items checked "No" in Sections 1 or 2. Deficient items must be corrected in a timely manner.

Item #	Corrective Action Planned/Taken	Date Corrected

CH2M HILL HEALTH AND SAFETY PLAN

Attachment 7

Applicable Material Safety Data Sheets

APPENDIX D

Standard Operating Procedures

STANDARD OPERATING PROCEDURE – OPS-14
MEC ANALOG DETECTION AND REMOVAL ACTIONS

1.0 PURPOSE

The purpose of this Standard Operating Procedure (SOP) is to provide all USA Environmental, Inc. (USAE) employees and subcontractors with the minimum procedures and safety and health requirements applicable to the conduct of analog detection and removal actions (mag and dig) at sites potentially containing unexploded ordnance (UXO) and/or munitions and explosives of concern (MEC).

2.0 SCOPE

This SOP applies to all USAE site personnel, including contractor and subcontractor personnel, involved in the conduct of analog detection and removal actions (mag and dig) on a UXO/MEC contaminated site. The following USAE policies and procedures are not all inclusive nor are they applicable in all situations. This SOP is not a stand-alone document and is to be used together with Work Plans, other USAE SOPs, the USAE Site Safety and Health Plan (SSHP), applicable Federal, State, and local regulations, and contract restrictions and guidance. Consult the documents listed in Section 7.0 of this SOP for additional compliance issues.

3.0 RESPONSIBILITIES

3.1 PROJECT MANAGER

The Project Manager is responsible for ensuring availability of resources to safely and effectively implement this SOP.

3.2 SITE MANAGER

The Site Manager is responsible for incorporating this SOP in plans, procedures, and training. In addition, he is responsible for oversight and supervision of field personnel, and ensuring compliance with this SOP.

3.3 UXO SAFETY OFFICER

The UXO Safety Officer (UXOSO) ensures that all mag and dig activities are conducted in a safe manner, in accordance with the approved Work Plan, the SSHP, this SOP, and all applicable regulatory guidance. The UXOSO's duties shall include, but are not limited to: analyzing UXO explosives operational risk, hazards, and safety requirements; establishing and ensuring compliance with all site-specific safety requirements for UXO and explosives operations; enforcing personnel limits and safety exclusion zones (EZ) for UXO clearance operations; and all activities associated with UXO and explosives transportation, storage, and destruction.

3.4 UXO QUALITY CONTROL SPECIALIST

The UXO Quality Control Specialist (UXOQCS) ensures compliance with the project Quality Control (QC) Plan and performs analog QC checks of completed grids in accordance with the Work Plan.

4.0 OPERATIONS

4.1 ANALOG DETECTION AND REMOVAL ACTIONS

All analog detection and removal (mag and dig) activities at MEC sites will be under the supervision of UXO qualified personnel. Non-UXO qualified personnel will not be allowed in the EZ during intrusive operations. If access is required by non-UXO qualified personnel, all work will stop while they are in the EZ. During operations, USAE personnel will strictly adhere to the SSHP and the following general safety practices:

- Operations will be conducted during daylight hours only.
- Access to operating areas will be limited to only those personnel necessary to accomplish the specific operation.
- UXO will only be handled by qualified UXO Technicians.
- During UXO operations the minimum separation distance (MSD) between UXO and non-UXO operations is fragmentation distance of the munition with the greatest fragmentation distance (MGFD), as stated in the Work Plan.
- During demolition operations personnel remaining on site will be limited to those personnel needed to safely and efficiently prepare the item/s for destruction.).
- All personnel will attend the daily safety briefing (tailgate safety briefing) prior to entering the operating area.
- Anyone can stop operations for an unsafe act or situation.
- Safety violations and/or unsafe acts will be immediately reported to the UXOSO.
- Failure to comply with safety rules/procedures may result in termination of employment.

4.2 GRID LAYOUT

A registered land surveyor will survey each of the clearance areas, accompanied by a UXO escort. Surveying activities will consist of locating clearance area boundaries, establishing permanent survey monuments, and establishing grids for geophysical investigation activities within the clearance areas.

Depending on the method selected and approved by the customer, the site layout and search grids will be established using a Global Positioning System (GPS), licensed surveyor, or compass and measuring tape. Survey crews will be escorted in the field by a UXO Technician II or above who will provide UXO avoidance including checking the intended survey stake locations with a magnetometer prior to driving stakes into the ground. This will prevent driving stakes into buried MEC.

4.3 ANALOG SWEEP PROCEDURES

Intrusive investigation team(s) will consist of a Team Leader (UXO Technician III) and UXO Technicians II/I. During intrusive operations UXO Technicians I will operate under the supervision of UXO Technicians II or III. UXO operations will only be performed by qualified UXO Technicians, which are defined as:

- MEC identification
- Access procedures such as excavation, either by hand or using heavy equipment
- Handling of MEC/UXO, explosives, or explosive items
- Disposal, including movement, transportation, and final disposal of MEC

Analog detector sweeps (i.e., mag and dig) are particularly effective in areas where vegetation and terrain limit the use of larger digital systems. Also, mag and dig approaches should be used when there is insufficient difference between UXO at the site and other metallic fragments and debris, such that digital discrimination is ineffective or cost prohibitive.

Initially, individual search lanes will be established approximately 5 feet (ft) wide. Each lane will be surveyed using a Schonstedt GA-52CX and/or White's XLT magnetometer. The operation will begin at one end of each lane and move in a forward direction toward the opposing baseline. During the forward movement the technician moves the magnetometer back and forth from one side of the lane to the other. Both forward movement and the swing of the magnetometer are performed at a pace that ensures the entire lane is searched and that the instrument is able to appropriately respond to subsurface anomalies. When a subsurface anomaly or metallic surface object is encountered, the UXO Technician halts and investigates the anomaly at that time. Throughout this operation the team leader closely monitors the team's individual performance to ensure these procedures are being performed correctly.

4.4 SURFACE UXO

Upon encountering a surface MEC it will be identified by two UXO Technicians and marked in accordance with the approved Work Plan for future disposition. If detonation cannot be arranged the same day as the MEC is identified, a guard will be posted during the non-working hours to ensure the item is not disturbed.

4.5 SUBSURFACE ANOMALIES

4.5.1 MANUAL EXCAVATIONS

Subsurface anomalies will be investigated by UXO-qualified personnel as they are identified during the sweep. All identified anomalies within the grid will be intrusively investigated. Excavations for individual anomalies will be conducted using the Schonstedt GA-52CX and/or White's XLT magnetometers to assist the team in determining the location and orientation of the target item. The UXO Technicians excavating anomalies shall initially remove no more than a 6-inch layer of soil along side the location of the anomaly, being careful not to impact the anomalous feature. The UXO Technician will conduct a visual and electronic search of the excavation to further pin point the anomaly source as needed. This process shall be repeated until the audible signal from the magnetometer indicates the object is close to the surface. Once this determination has been made, soil will be removed by hand until the source of the anomaly is located. Excavations on individual anomalies greater than 4 ft below the ground surface (bgs) will not be made without prior approval of the U.S. Army Corps of Engineers (USACE) OE Safety Specialist.

4.5.2 MECHANICAL HANDLING EQUIPMENT

Mechanical Handling Equipment (MHE) may be used to excavate large anomalies (e.g., pits) or those deeper than 4 ft bgs if required (e.g., to confirm the anomaly is not a MEC). Any decision to use MHE to excavate these anomalies will be made by the SUXOS and the USACE OE Safety Specialist (see SOP OPS-06, Excavation and Trenching for detailed MHE procedures). The excavation will proceed slowly to ensure the item is not broached by the MHE. If the excavated material is considered to be a MEC, it shall be uncovered sufficiently by hand to obtain a positive identification of the item. If the item is identified as UXO/MEC, a determination will subsequently be made as to whether it is fuzed or not.

While excavating with MHE, a UXO Technician will be stationed in a position that is out of the reach of the excavation equipment but affords a view of the excavation site. This observer will ensure that the next lift is visually free of UXO. The excavated material will be placed onto the ground within a screening area that has been surface swept and the boundaries recorded. The soil spoils will be spread across the screening area using the excavator bucket. The excavated material will be screened for range related debris, munitions debris, and UXO/MEC items. UXO technicians will recover all pieces of munitions debris or range related debris and any ordnance items. After screening, the soil spoils will be stockpiled to the side of the screening area.

5.0 RECORD KEEPING

The team leader will maintain a field logbook, which at a minimum will contain a record of the following:

- Weather
- Instrument details and serial number
- Team Personnel
- Grids worked
- Start and stop times
- MEC/UXO items encountered

The data to be recorded for each item discovered during anomaly excavation will include the following (as applicable):

- Type (e.g., MD, MPPEH, UXO, and non-MEC Scrap)
- Description (e.g., "projo, 20-mm, practice, MK105" and "base, coupling, firing device")
- Initial Condition (e.g., expended, inert, live, and to be determined [TBD])
- Approximate length
- Approximate width
- Depth
- Approximate weight
- Found in a pit?
- Piece of frag?
- Initial disposition (e.g., left in place and removed to scrap pile)
- Requires demolition?

All data will be turned into the Site Geophysicist at the end of the day.

6.0 DISPOSAL OPERATIONS

Fuzed UXO/MEC items will be blown in place (BIP), and un-fuzed UXO/MEC items will be consolidated whenever possible in accordance with USACE Engineer Pamphlet 1110-1-17, Establishing a Temporary Open Burn and Open Detonation Site for Conventional Ordnance and Explosives Projects, dated 16 July 1999, Appendix D. In no case shall the SUXOS authorize or undertake destruction of UXO/MEC when there is sufficient reason to believe that the disposal action will result in personnel casualties or property damage. The USACE OE Safety Specialist will be consulted for guidance in the event that there is sufficient reason to believe that the disposal action will result in personnel casualties or property damage.

7.0 REFERENCES

- USACE Safety Considerations for UXO

- USAE Corporate Safety and Health Program (CSHP)
- OSHA, 29 CFR 1910, Occupational Safety and Health Standards
- OSHA, 29 CFR 1926, Construction Standards
- Applicable sections of EPA, 40 CFR Parts 260 to 299, Protection of Environment
- Applicable sections of DOT, 49 CFR Parts 100 to 199, Transportation
- USACE EM 385-1-1, Safety and Health Requirements Manual
- USACE ER 385-1-92, Safety and Occupational Health Document Requirements for Hazardous Waste Remedial Actions
- DOD 4145.26-M, Contractors' Safety Manual for Ammunition and Explosives
- DOD 6055.9-STD, DOD Ammunition and Explosives Safety Standards
- DOD 4160.21-M, Defense Reutilization and Marketing Manual
- DA PAM 385-64, Ammunition and Explosives Safety Standards
- AR 385-64, Ammunition and Explosives Safety Standards
- AR 200-1, Environmental Protection and Enhancement
- AR 385-10, The Army Safety Program
- AR 385-16, System Safety Engineering and Management
- AR 385-40 w/USACE supplement, Accident Reporting and Records
- TM 9-1300-200, Ammunition General
- TM 9-1300-214, Military Explosives
- TM 60 Series Publications